old and truest sense) that links together all our diverse interests. We must never lose sight of the essential *unity* of pathological processes. Though clinical medicine sees one aspect of a disease, and radiology another, and morbid anatomy a third, and parasitology a fourth, the disease is one and the same, and our best conception of it is obtained, not by undue insistence upon any one of these aspects, but by a proportionate mingling of the pictures presented by all. He who achieves the most complete conception of a disease in his mind is the most likely to envisage the appropriate treatment and get the best result. None of us can afford to neglect the facts elicited by the methods of others; indeed, our own methods will yield us more facts, and a clearer vision, in exact proportion as we allow them to be guided and controlled by the methods of others. It is of the utmost importance that we keep our minds alert and free from stereotyped ideas, yet bound always, fettered even, by the principles of science and reason, with a healthy scepticism withal—that saving grace so essential to the scientific mind. Let us remember that our present notions of diseases, even when we think them very complete, are probably extremely crude. We have already ample experience that this is so. Not only are they crude in respect of the extent and the complexity of the disease process, as instanced earlier in this address, but in respect of the course diseases run and their response to our efforts at treatment. The problems of pathology become more elusive and yet more fascinating the closer we study them. It is a glorious contribution to such study that you are making to-day by means of radiology, both in its diagnostic and in its therapeutic values. The memory of him in whose name we meet together to-day is, I feel sure, being well served by you who follow him. I wish to congratulate you upon the fine work with which you are supplementing his and other pioneer achievements, and I shall have justified myself if anything I have said serves to stimulate you to further efforts and yet greater results.

Hunterian Lecture

ON

CANCER OF THE CERVIX.

(With Special Plate.)

DELIVERED BEFORE THE ROYAL COLLEGE OF SURGEONS,
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BY

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(Abridged.)

ETIOLOGY OF CANCER.

MODERN methods of experimental research have resulted in the production of cancer in animals at will. This result, together with Drew's observations upon the culture of tissues and tumours *in vitro*, are notable steps in the solution of the secret of cancer. Already theories which have held sway for generations have been demolished. The vague conception of tissue tension is no longer tenable, and the behaviour of malignant and benign cells during growth *in vitro* shows conclusively that Hansemann's theory of anaplasia is unfounded, whereas it confirms the view that tumour formation ensues upon chronic irritation. The production of tar cancer shows that there is a variable latent period between the application of the irritant and the appearance of the new growth, from which some interesting conclusions follow. A close study of cancer in human beings frequently fails to disclose recent evidence of tissue irritation; nevertheless, the irritant may have produced cell changes which are not histologically recognizable at the time, but long after the irritant has ceased to act the tissues exhibit malignant change. This is borne out by Leitch's experiments with tar cancer. He noted that, even though he stopped the application of tar before there was any sign of malignant change, warts appeared in due course and malignant evolution took place.

Furthermore, it has been shown that tumours which are

apparently benign may develop into malignant growths, and that injury, which of itself is not capable of producing cancer, will greatly accelerate the development of cancer after the application of a suitable irritant. Finally, there is the important fact established by Murray, that mice which have developed tar cancer will not develop a second tumour despite continued irritation, which observation offers an explanation of the rarity of multiple carcinomata in man. It shows that the mouse acquires immunity to the growth of further tumours, which is also borne out by the observation that certain inoculated tumours, after a period of growth, came to a standstill and were finally absorbed. Attempts to reinoculate the same mice with the same tumour completely failed, and they showed greater resistance than normal mice to other tumours. Bashford and Murray have shown that this resistance is of the nature of an active immunity.

Proemial Conditions.

I agree with Lenthal Cheate that this description is more exact than precancerous or precursory. Erosions, fissures, lacerations, and chronic cervicitis are described as fore-runners of cancer of the cervix, but as one or more of these lesions are invariably present in parous women, and as 90 per cent. of this disease occurs in that group, the evidence is not too convincing. Since, however, experimental cancer is shown to be dependent upon irritation, it is possible that any of these lesions is an indication that the irritant is present, and where it happens upon favourable ground malignant growth ensues. I investigated a large number of uteri of some of the more prolific domesticated animals—the cow, sow, bitch, and cat—with the object of ascertaining whether any of these lesions could be found in them. The cervixes of the cow and sow are formed of a rosette of protuberant cervical mucosa, and it was not possible to detect by naked-eye examination whether minor tears and lacerations were present or not; but in none of the organs examined was there any gross lesion, and on microscopic examination there was no evidence of cervicitis. In the cat and bitch the cervix has a less complicated structure and is therefore more satisfactory for examination. No evidence of laceration or chronic inflammatory lesion was found. Professor Wooldridge informs me that carcinoma of the uterus is exceedingly rare in any animal; nevertheless, it is of interest to note the rarity of both types of lesion which are so frequently associated in cancer of the cervix in women.

Erosions.—There is suggestive evidence that the papillary erosion stands in some sort of relation to cancer; four cases of interest have been under my observation.

One had been an in-patient for chronic cervicitis with a papillary erosion. She came under my observation nine months later with an extensive carcinoma of the cervix.

Another was treated similarly and a piece removed for section, which showed no malignant change; fifteen months later she came under observation with an inoperable growth of the cervix.

A third was regarded as an erosion, but as it bled a little more than usual she was entered for admission, with a view to exploration. She escaped observation for five months, and then returned with an inoperable cancer.

The fourth had been treated as a cervicitis, and seven months later came under my care with advanced cancer.

There is another type of lesion of which I have met three cases in all, and for want of a better description it may be called the "bleeding cervix."

Bleeding Cervix.—The whole cervix is soft and spongy, dark red in colour, bleeds persistently when swabbed, and a probe sinks into its substance. The haemorrhage resembles that which takes place from the surface of a granulating wound—numerous minute drops of blood ooze out, run together and form a stream. It differs from the haemorrhage of the papillary erosion, for that ceases at once with a little pressure, but this persists and may require a gauze plug to enable the patient to get home.

In one of these cases the bleeding persisted daily for a week, and I finally amputated the cervix. This patient died twelve months later from carcinoma of the stump of the cervix.

A second became malignant, and I removed the uterus.

The third is now under observation, and as the microscopic examination did not justify the radical operation I treated her with radium. The microscopic appearances are those of angioma. The deep part of the section shows evidence of cervicitis; the epithelium is squamous and shows no evidence of proliferation, the striking feature being the number of blood vessels in the section.

There is little doubt that, apart from local lesions, anything which tends to lower the resistance of a patient is a contributory cause to the development of cancer. It is a curious fact that cancer of the womb is very largely a disease of the hospital class of patient, who have large families and are more prone to suffer from neglected infections than the well-to-do class. In addition to which, environment, malnutrition, and alcoholism play no small part in depriving the organism of the natural power of resistance.

In 200 cases of cancer of the cervix there was no evidence of hereditary influence. There were seven cases between 20 and 30 years of age, forty cases over 60, the majority occurring between 45 and 55. The incidence in nulliparous women was 12 per cent. Twenty-seven of these cases had undergone some form of operation: subtotal hysterectomy 5, amputation of cervix 1, cervical polypi 4, dilatation and curettage 5, ovariectomy 6, miscellaneous operations 6. Ten of the cases were associated with some degree of prolapse, for which a pessary had been worn for some time, and three were associated with fibroids.

SYMPTOMS.

The signs and symptoms of cancer of the cervix are entirely dependent upon the conditions of the growth and the extent to which it is protected from infection. Carcinoma begins as a proliferation of tissue cells with the formation of a microscopic tumour. Ulceration of that tumour only takes place when the supply of nourishment fails to keep pace with the new growth, and it is with the advent of ulceration that symptoms first appear. These symptoms may be so slight as to remain unnoticed or appear so trivial as to be ignored until the ulcer becomes infected. The importance of infection of a malignant growth cannot be exaggerated, for two results ensue—increased rapidity of growth, and increased rapidity of necrosis with the consequent foul discharge and haemorrhage. In this connexion it is well to recall the experiments of Bashford and Murray, who found that mice could support enormous tumours without showing any disturbance, even though metastases had formed; but with the appearance of ulceration and infection, emaciation and death soon followed. The cervix is situated at the upper end of the vagina, and so long as that canal is anatomically intact and does not function infection may be long delayed. This is well borne out in elderly women who are past sexual life, and in whom the vagina is a narrow atrophic cavity. There were forty such cases in this series, all over 60 years of age, four of which were submitted to operation, the remainder being inoperable. The analysis of the duration of symptoms in these cases is as follows:

4 weeks ...	...	...	4	9 weeks ...	...	...	4
5 " ...	...	...	2	10 " ...	...	...	3
6 " ...	...	...	2	12 " ...	...	...	4
7 " ...	...	...	4	16 " ...	...	...	3
8 " ...	...	...	3				

It is clear from this table that any attempt to gauge the age of the lesion from the initial appearance of symptoms is liable to a large margin of error, and any deduction based upon such a foundation is fallacious. Friability is regarded as almost pathognomonic of cancer, and undoubtedly it is in an extensive growth, but in a recently formed ulcer the degree of friability is small and as a sign of early cancer its value is greatly exaggerated.

Histological Type in Relation to Malignancy.

Krompecher first pointed out that many tumours which grow in the skin and are derived from it are different in structure and biologically behave in a different way from squamous epithelioma. He regarded them as being derived from the basal layers of the skin, for which reason they show no tendency to keratinization or pearl formation. These tumours, which include rodent ulcer, are relatively benign and are described as basal-cell cancer. Continental observers lay stress upon this division and recognize (a) basal-celled, (b) spinous (squamous epithelioma), (c) an intermediate group having some characters of both types. They hold that the basal-cell type is relatively benign and

highly radio-sensitive, whereas the spinous-cell type is very malignant and relatively radio-resistant.

Martzloff (Johns Hopkins Hospital) investigated the histology of 257 cancers of the cervix in an attempt to correlate the type of malignant cell with the subsequent clinical history of the patient. He classified the growths as (1) spinal-cell type (squamous epithelioma), (2) transitional type, (3) fat spindle type, which corresponds to the basal-cell cancer. His observations suggest that the fat spindle type was the most malignant despite its correspondence with the relatively benign basal-cell cancer of the skin. The transitional type was next in order of malignancy, and the spinal-cell type was relatively least malignant. He further noted that inoperability was most frequently associated with the transitional and fat spindle types.

Here are two directly opposed views on what appears to be a definite issue, the difference being due to the difficulty of classifying these tumours in the way which the opponents have done. My experience shows that these divisions are highly artificial, for sections taken from different parts of the same tumour might place the growth in Group 1, 2, or 3; and of twelve sections from different tumours, two would belong to Group 1, two to Group 3, and of the other eight a difference of opinion would exist amongst competent histologists as to whether they belonged to the one or the other, or whether they should form a third group. The division of these tumours into twelve subgroups based upon the numerical predominance of one type of cell appears to me to offer little profit for much labour, and no conclusions of value can be deduced from it. Looking through the sections of my cases in the light of subsequent clinical history, I find myself quite unable to correlate the type of malignant cell with the degree of malignancy. With the exception that a very cellular growth is an acute lesion, while a tumour which shows fibrous reaction is more chronic, little information as to the future is to be gained from the type of cell. We are accustomed to the uncertainty attending tumours which present almost identical features under the microscope—how one tumour grows rapidly and kills the patient quickly, whereas another may take years to compass the same end. The laboratory propagation of mouse tumours has shown that histological structure is a poor gauge of biological character, and experiment has closed the interval between normal tissue and undifferentiated tumour tissue, by the production of a series of tumours with increasing differentiation.

DIAGNOSIS.

Early diagnosis depends upon digital examination and visual inspection through a speculum at the onset of symptoms and the removal of a piece of tissue for section. This operation is best done under anaesthesia, for the vagina and cervix can be properly cleansed, and the wound closed with a catgut suture. The tissue removed must include a part of the growth and some of the underlying healthy tissue. Asepsis is vital, for once a growth becomes infected it is impossible to sterilize it. Attention has already been drawn to the association of papillary erosions with cancer, and the imperative necessity of microscopic diagnosis. This applies to polypi, and to ulcers which do not heal rapidly under treatment; cases of syphilitic and tuberculous lesions are recorded as having been excised as cancerous growths.

Is the Growth Operable?

In answering this question we must bear in mind that the real question is: "Can the growth be completely removed with a margin of healthy tissue?" In estimating the clinical signs we must allow for the microscopical tumour being some distance in advance of the clinical tumour, and that in 25 per cent. of cases which are clinically limited to the cervix malignant cells are present in the parametrium.

Induration of the surrounding tissue is not essentially malignant, but may be an inflammatory oedema associated with an ulcerated growth tending to disappear with appropriate treatment.

Fixation of the uterus is the first point to decide, which is best done by the bimanual examination. Limitation of movement may be due to an old inflammatory lesion or to the ramification of the growth, and it is often impossible

to decide between them. When due to growth complete removal is impossible, and when due to inflammatory lesion the difficulties attending the radical operation are greatly increased, and the operative mortality proportionally higher. The utero-sacral ligaments are best examined through the rectum, for the finger reaches a higher level, and the side walls of the pelvis can be explored at the same time. When the anterior lip of the cervix is involved cystoscopic examination of the bladder is imperative, and the ureters should be catheterized if necessary, for in comparatively early cases the base of the bladder is frequently infiltrated, and may show an elevation behind the trigone or an asymmetrical prominence of the trigone itself, on the summit of which is placed the ureteral orifice.

The appearance of a diffuse oedema, or more frequently a bullous oedema, due to infiltration of the veins and lymphatics of the base, is not uncommonly present. The oedema may be limited to the ureteral orifice, which presents a gaping mouth—an appearance which suggests that the ureter is compressed by growth. The left ureter is much more frequently involved than the right, which I believe is accounted for by Brasch's description of the relations of the ureter to the cervix and vagina. The majority of abandoned operations are due to infiltration of the bladder, which is the type of case where an antecedent cystoscopy would have obviated the operation. With the diagnosis of cancer of the cervix any of these appearances contraindicate the radical operation, for involvement of the base of the bladder and ureter is an absolute bar, in my opinion, to any attempt at removal of the tumour. For although resection of these organs is commonly successful in vesical tumours, cancer of the cervix so extensive as to involve them is too extensive to eradicate. Involvement of the rectum is rare, except in the late stages of the disease, and rectal symptoms are more often due to pressure than to infiltration by growth.

TREATMENT.

The operative treatment of cancer of the cervix has undergone great change in the last twenty-five years—local excision of the disease by knife or cautery, supravaginal amputation of the cervix, vaginal hysterectomy, and, last of all, the radical abdominal operation. The limits of this last operation vary with the individual surgeon, from pan-hysterectomy with excision of as much parametrial and vaginal tissue as possible, to resection of bladder, ureters, bowel, and more or less of the pelvic fascia and glands. The mortality in the more extensive operations is as high as 70 per cent., and probably is rarely below 30 per cent.; the average for all cases is 20 per cent., and for early cases 6 per cent. The radical operation has now been practised widely for twenty years, and for early cases it has general support, but there is an increasing number of surgeons who question the wisdom of applying this operation to cancer which has clinically extended into the pericervical tissues, for the results are deplorable, and of those who survive the operation less than 10 per cent. are alive a year later (Martzloff). Further, it is disputed whether the radical abdominal operation shows any great improvement in results over the vaginal operation.

The Schauta Clinic treat all operable cases of cancer of the cervix by vaginal hysterectomy, and claim that their operability rate and freedom from recurrence over five years is equal to that of the Wertheim operation, while the mortality is only 20 to 25 per cent. of the latter. It would seem, therefore, that the time has come to estimate the legitimate scope of the abdominal operation, and numerous surgeons—notably Kelly and Burnham in America, Bumm, Döderlein, Pozzi, Flatau, and Recasens in Europe—have assessed its value by abandoning the radical operation for all cases where the growth exceeds the limits of the cervix clinically. They have reason for this attitude, inasmuch as the high mortality and pitiable end-results occur in the extensive growths, whereas the mortality and results of early cases are comparable to the most favourable of cancer operations. At the outset cancer is a local disease, and in a majority of early cases the growth can be completely removed surgically. I think the reverse is equally true—that once the growth is recognized clinically to have involved

the pericervical tissues it is rarely or never completely removed, and few patients remain free for any length of time. If the operative results are to improve, our aim must be to get cases at an earlier stage of the disease rather than to strain operative technique to breaking point in an endeavour to deal with advanced cases.

In the discussion of treatment it is necessary to have some clinical division, and the following method seems convenient.

Early Cases.—Cases where the growth is limited to the cervix; in a minority of these only a part of the cervix is involved, and after the radical operation a large proportion of these should remain cured. In a majority of early cases the cervix is extensively infiltrated, yet no extension to the surrounding tissues can be made out, and the uterus is free. These cases are operable, but it is well to remember that in 25 per cent. of them cancer cells can be shown in the parametrial tissue removed, and with more efficient methods they would probably be found in a higher percentage of cases. This class of growth contributes a number of recurrences, but the operative mortality from these two divisions should not be more than 6 to 7 per cent.

Borderline Group.—Cases where one or both broad ligaments are infiltrated, and there is some fixation of the uterus; the growth may involve the vaginal wall or the patient may have a persistent frequency of micturition.

Advanced Cases.—These all surgeons regard as inoperable, with an extensive tumour fixing the uterus, involving the pelvic floor, base of the bladder, and maybe with recognizable secondary deposits.

The *early groups* are universally accepted as being proper operative risks, and if surgery were limited to them the operative mortality would be as low as 6 to 7 per cent. and a curability rate of 70 to 75 per cent. of operated cases would probably be obtained.

The *borderline group* forms the battle-ground where issue is joined by the advocates of the radical operation and the advocates of radiation. The term "borderline" denotes doubt in the surgeon's mind whether he can remove the growth entirely, so offering the patient some chance of cure. The problem is not whether the growth can be removed as a surgical feat, but whether it can be removed at a reasonable risk and with a reasonable chance of cure. Two schools of surgeons answer this question in different ways: One takes up the position that every case of cancer of the cervix in which there appears any chance, however small, of removing the growth, should be submitted to operation. This policy leads to a high operative mortality, a number of abandoned operations, a number of cases of incomplete removal of the growth, and a few cases which remain well over a variable period of time. Martzloff found that less than 10 per cent. survived for a year after operation, and that the mortality reached 70 per cent. in one year and was never less than 25 per cent.—a prohibitive rate from which that clinic recoiled. The other school has answered the question by placing the borderline case in the inoperable class and treating it by radiation.

I have notes of 50 borderline cases treated by the radical operation in which the parametria were infiltrated by growth, many of which came under my observation for treatment of recurrence of the growth. The most striking feature of this study is the large number of early recurrences and the consequent relief was so transient as to be negligible.

Of the 50 cases, 10 are living and 40 dead.

Of the 10 alive, 6 remain well over periods of 5½, 4½, 4, 4, 3½, and 3 years; 2 remain well between one and two years; 2 are alive with recurrence under twelve months.

Of the 40 dead, 8 recurred in two to six months; 14 recurred between six and eleven months; 7 recurred at the end of twelve months; 7 recurred between one and two years; and 4 between two and three and a half years.

Some of the earlier recurrences were probably cases of incomplete removal of the growth. The high mortality, rapid recurrence, and poor end-results must cast grave doubt upon the wisdom of radical operation in this group; nevertheless, it might be justified if there was no alternative. There is, however, ample evidence, from various clinics in different countries, to show that better results are

FIG. 1.—Section of tissue removed after scraping away necrotic growth down to firm tissue.

FIG. 2.—Section removed four weeks later after two exposures to radium. The mass of growth is broken up into scattered islets of malignant cells. There is a great development of young fibrous tissue.

FIG. 3.—Section removed two months after No. 1, after three exposures to radium. No malignant cells can be identified even under a high power.

FIG. 4.—Left ovary. Death after eight days. Radium at a distance of 2 cm. for twenty-four hours. $\times 200$.

FIG. 5.—Right ovary of the same animal as No. 4, but painted with copper sulphate, in addition to radium at a distance of 2 cm. for twenty-four hours. Survival eight days. $\times 200$.

obtained from radium than operation in this group, and the following are worth consideration.

- Bumm: Of 81 borderline cases 29 per cent., and of 127 advanced cases 7 per cent., were free five years later.
 Döderlein: Of borderline cases 36 per cent., and of advanced cases 11 per cent., were free five years later.
 Kelly, who classifies these two groups as inoperable, had 69 cases (21 per cent.) free from disease, 7 of which were for five years and over.
 Heyman: Of 26 inoperable cases, 7 (28 per cent.) were free five years later.
 Adler: Of 52 inoperable cases, 13 (25 per cent.) were free five years later.
 Van Seuffert: Of 62 inoperable cases, 14 (22.5 per cent.) were free five years later.
 Burrows: Of 100 inoperable cases, 6 (6 per cent.) were free from three and a half to four years later.

Treatment by Radiation.

The treatment of cancer of the cervix by radium is so recent, and the methods of using it are so varied, that the optimum technique is not yet agreed. The present radiological methods in cancer are comparable to the surgical practice of twenty-five years ago—namely, amputation of the cervix. With improved technique and research we may assuredly look forward to better results. It is necessary to inquire what radium can do, and the answer is that, directly or indirectly, it destroys all tissue cells if the dose be large enough. Secondly, some cells are more vulnerable to radiation than others—for example, Graafian follicles are easily destroyed, whereas lutein cells, stroma cells, muscle, and cartilage require from four to six times the dose to produce destructive effects, and therefore, relatively to the Graafian follicles, they are resistant. In the same way malignant cells are more vulnerable to radiation than normal tissue cells, and therefore theoretically radium is capable of curing cancer. This desirable result is dependent upon the application of the lethal tumour dose to every bit of the tumour, a difficult condition to attain, for the radius of action of radium is small and this action deteriorates in accordance with the law of inverse squares.

How radium acts is another question of importance, the answer to which remains unknown. We know that it acts most surely upon rapidly dividing cells, and that the first histological change seen is in the nucleus of the cell; but the structure of the cell offers no help in solving the problem, and we shall probably have to wait until we learn more about the chemistry and physics of cell life before the question is answered. The change in the nucleus appears as loss of staining power, shrinking, and fragmentation and vacuolation. Concurrently with the nuclear changes an extensive formation of connective tissue takes place in the stroma; this fibrous tissue pushes its way into the alveoli of malignant cells, breaking them up into isolated clusters. It finally surrounds them and the cancer cells fade away, until finally no trace of malignant cells can be found in the section. This formation of fibrous tissue is remarkably like that seen in atrophic scirrhus of the breast. (See Figs. 1 to 3.) Clinically radium is suitable for 90 per cent. of advanced cases, the contraindications being:

- (a) Cases complicated with an old pelvic peritonitis.
- (b) Cachectic cases.
- (c) Fistulae, or where the vesico-vaginal or recto-vaginal septa are massively infiltrated.
- (d) Cases with extensive secondary deposits and nerve root pain.

All cases, with the above exceptions, are worth treating, for the amelioration of symptoms is incredible to anyone who has not had experience of it, and the comfort of a woman no longer suffering from constant haemorrhage and foul discharge is a striking contrast to a woman whose offensive discharge is noticeable to those around her. The improvement is so great, even after one exposure, that some patients disappear for a time under the impression that all is well, only to return later when the symptoms recur. One of the drawbacks of radium is that it requires several exposures, each one of which means an anaesthetic, with which patients become disheartened. Another difficulty is to know when to stop irradiation. The ulcer is healed and the cervix looks normal, though red; a piece of tissue removed at this stage shows no malignant cells. There is thickening in the vault of the vagina and the fornices.

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Is it fibrous tissue or growth? Too often it turns out to be growth, but further irradiation at this stage produces no change in the irradiated area and may produce a burn.

Adjuncts to Radium.

Copper and selenium have been used empirically in the treatment of cancer for a considerable time. I tried collosol selenium in a series of cases, but did not find any influence exerted on the tumour. I then tried a series of cases with collosol copper in addition to radium, and after a lengthy trial was satisfied that in some way or other it assists in the destruction of the growth. Malignant ulcers, which had contracted but became callous and refractory to further irradiation, would tolerate further exposures, and the healing process was resumed after the injection of collosol copper. I undertook some animal experiments, exposing the ovaries of cats to radium with and without the application of copper salts, and the results bear out the clinical observations. The large follicles are so quickly destroyed by radium that it is necessary to study the primary follicles; these in the copperized ovary show a greater extent of destruction than those of the opposite side, the change consisting in diminution of size, poor staining reaction, and disappearance of the ovum, with loss of definition of follicular contents. These changes are gradual, but were consistently found in all the experiments. Figs. 4 and 5 show these changes in an animal which survived eight days.

Pre- and Post-operative Radiation.

The policy of irradiating a tumour before operation is limited by the formation of dense fibrous tissue, which may render the dissection of the ureters impossible. If, however, the operation be proceeded with in ten to twelve days this difficulty is anticipated. The advantages of pre-operative radiation are that it diminishes the pyogenic infection and cleans up the growth; and, secondly, it destroys malignant cells which may remain in the unexcised parametrium. I have found degenerating cancer cells in sections removed from the pelvic tissues just beyond the line of excision, after exposure to radium.

Post-operative radiation is a difficult problem, for it is not easy to avoid the bladder and rectum after the removal of the uterus. Professor Adler places radium tubes on either side of the pelvis at the time of operation, deep x rays to the pelvic tissues after recovery, and finds that 61 per cent. have remained free from recurrence after three years' observation, as against 52 per cent. of non-irradiated cases. I am treating all my operative cases by pre- and post-operative irradiation, but it is yet too early to consider results.

I have notes of fifty cases of cancer of the cervix treated by radium and colloidal copper more than nine months old, and I propose to consider them in detail, for reference to cases of a lesser period would have little value.

All the cases were clinically and microscopically carcinoma; all except three were inoperable and referred to me with a view to relieving their misery by radium. The growth was extensive, sometimes crowding the pelvis minor, the uterus fixed, broad ligaments involved, and the floor of the pelvis a solid plaque of growth, with pressure on the bladder, rectum, and veins. They were all given radium, provided there were no contraindications, and even though no permanent result ensued the relief obtained from haemorrhage, fetid discharge, and foul ulcer was an inestimable boon in their last phase. It will be realized that the utmost expected in such cases was palliation of symptoms; nevertheless I think in some cases life was prolonged as well.

The three exceptions mentioned were comparatively early cases, in which the disease was clinically limited to the cervix, but their general condition was too poor to allow of the radical operation being undertaken. The three were referred to me by one or other of my colleagues for treatment by radium. One of them died, a month after the initial exposure, from an acute toxæmia of doubtful origin. The other two remain alive and well two years and seven months and two years and six months after treatment; one of them was treated by x rays in addition to radium, the other by radium alone.

Of the 50 cases, 38 are dead and 12 living. The 12 living are well and free from symptoms, and so far as physical examination can tell are free from growth for 2½, 2½, 2½, 1½, 1½, 1½, 1½ years, 1 year, ½, ½, ½, ½ year.

Of the 38 cases dead, 27 were relieved of all symptoms, 3 abandoned treatment, 8 were unrelieved, 5 of whom were recurrences following operation, and 3 were so extensive that only one exposure was given owing to the risk of fistula formation.

Of those with complete relief of symptoms, 9 lived between one and one and three-quarter years; 8 between six and twelve months; and 10 between two and six months.

Symptoms.

Haemorrhage, which varied from slight irregular losses to severe flooding, ceased within a few days of the first exposure. In two cases the haemorrhage returned after several exposures and was so free that ligature of the internal iliacs was undertaken in order to control it. These two cases were probably examples of irradiation of a tumour which had become radio-resistant. I had also to ligature these vessels in a third case, but here the haemorrhage was a true secondary haemorrhage occurring in an extensive and virulently infected growth, and, following the exposure, a massive necrosis of tissues took place.

Bloody Discharge.—This undergoes rapid improvement, the blood ceasing within a few days, the discharge becoming thinner and losing its offensive character in three weeks, concurrently with the cleansing and healing of the ulcer. At the end of a month it is watery and small in quantity with a musty odour, and at the end of six weeks has ceased.

Pain.—In some form or other pain is usually present, but is either of the nature of a long-standing backache, which remains uninfluenced, or a dull ache in the pelvis due to infection and oedema of the cellular tissues. This type of pain is commonly relieved, and patients who have been taking phenacetin and bromides at night are able to do without after the first exposure. The late pains due to involvement of nerve roots or secondary deposits in the spine are not influenced in any way.

Local Ulcer.—The ulcer which at the first exposure admitted the tips of two fingers will, at the end of a month, barely admit one tube of radium in its metal and rubber screens, which is equivalent in thickness to the ordinary lead pencil, and at the end of six weeks the cervix, though red, is covered with epithelium and has a normal appearance. The general condition improves with the disappearance of the infected focus; the colour, appetite, and general well-being undergo a great change for the better.

A serious limitation to treatment by radium in early cases is that short of opening the abdomen it is not possible to say whether the glands are involved or not, and, if they are, the irradiation of the primary growth is merely palliative. The glands are found to be infected with growth in 30 per cent. of cases that come to operation, which should exclude the advocates of radium for early cases until they are able to show how they deal with these deposits effectively. Daels has introduced an ingenious operation for dealing with pelvic deposits by passing radium from the iliac fossa to the perineum on a chain. In this way he irradiates a variable area of the pelvic cavity. This operation does not meet the fundamental rule that the radium must be placed in contact with the growth, for its power diminishes in accordance with the law of inverse squares, and while the tube may be placed opposite the sacro-iliac synchondrosis the infected gland may be some distance away from it.

Opening the abdomen and implanting the radium in the growth is the only way of being certain that it is placed where it should be, and this, while very satisfactory up to a point, is limited by the fact that it may have to be repeated several times. The Erlangen method of deep x-ray therapy was originally proclaimed as a cure for cancer of the cervix, but its value was soon assessed, and it is now reserved for the palliation of symptoms in inoperable cases, prophylactic irradiation after operation, and the irradiation of pelvic tissues in conjunction with radium to the cervix.

CONCLUSIONS.

1. That for cases of carcinoma clinically limited to the cervix the only treatment is operative.
2. That for cases which have clinically invaded the pericervical tissues the treatment is by radium to the cervix and x rays to the pelvic tissues.
3. That salts of copper play an important though subsidiary part in treatment by radium.
4. That pre- and post-operative irradiation is of considerable value.

I am indebted to Professor Brasch for permission to use his diagrams and slides.

A CASE OF HERNIA INTO THE INFERIOR DUODENAL FOSSA.

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WITH X-RAY PLATES AND REPORT

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(With Special Plate.)

THERE seem to be certain minor differences in the classification of the fossae round about the duodenum. Walton refers to an inferior duodenal fossa, a superior duodenal fossa, and a paraduodenal fossa. This also appears to be Cunningham's classification. Moynihan, according to Makins, in *Burghard's System of Operative Surgery*, classifies them as right duodenal hernia and left duodenal hernia. His right duodenal hernia apparently corresponds to both the superior and inferior ones in the classification of the other writers, and his left duodenal hernia corresponds to the paraduodenal variety, although he calls it a hernia into the duodeno-jejunal fossa. Beesly and Johnston mention four fossae—namely, superior, inferior, paraduodenal, and retroduodenal.

E. H. B., born December 15th, 1914.

History.—The mother states that she had an easy labour, but was taken to the hospital immediately after the birth of the child because she had fits and because there was something wrong with her kidneys. The baby (the subject of the present paper) was left with a nurse. He vomited practically from birth and the vomiting was of a projectile character. He was fed on sherry, whey, and brandy and white of egg for the first month or so; then various patent foods were tried, but he vomited them all. When he was 5 months old the doctor advised nutrine. At first he vomited this, but after about five weeks he kept it down and did not vomit again, except when he was given anything else. Up to the age of 2 years he could keep nothing else down. He gained a little weight but lost it again. His weight went up and down, never very much up, and at 2 years of age—as far as his mother can recollect—he was 6 lb. under the weight for his age. At this age he would be lying in his mother's arms and suddenly he would go into a fit. The doctor had prescribed two powders a day for him, and the mother thinks that these powders kept his bowels moving, for when she stopped them he did not seem so well and was a little constipated. When he was 2 years old his sisters contracted measles, but he did not contract the disease. He vomited continuously, however, and was fed on brandy and egg-flip. Although he did not contract measles another doctor who saw him later said that he was getting over an attack of pneumonia. When the boy was in his third year he seemed to improve in health, and he had no other disease or illness beyond vomiting when he was given anything except bread-and-butter and a little jam, strained soup, and porridge. If the soup were not strained, he vomited it. Oranges, bananas, grapes, currants, and raisins, or cake containing currants and raisins, seemed specially to cause him to vomit. He always had a bad breath and his stomach made a rolling gurgling noise at night, more especially immediately before a vomiting bout. If he ate any of the above-mentioned things he rolled on the floor in pain until he vomited. He was active and played about like any ordinary child, and was an average child at school. His mother gave him Epsom salts every Sunday, and thought they kept him more or less in health. He was brought to me when 8½ years old (November 21st, 1923), some days after a birthday party at which he had had, amongst other things, fruit and ice-cream in large quantities.

Family History.—The families of the father and mother are healthy. This boy was the fifth of five children; the eldest was a full-time child, but died two hours after birth, cause unknown; the second is a girl 15 years old and healthy; the third is a girl 12 years old and healthy; the fourth was a girl who died at the age of 11 days, because she could not feed properly owing to some deformity.

He was a small, "pot-bellied" boy, who seemed wasted but whose abdominal muscles seemed to be over-developed. He did not complain of pain anywhere in the abdomen, nor was there any tenderness in the abdomen. The stomach was obviously enlarged on percussion, but no tumour could be felt over the pyloric region. There was a good deal of gurgling in what I took to be the caecum. He was admitted to the Memorial Hospital for Children, put on ordinary diet, and kept under observation from November 22nd to 30th, 1923, and during that time he did not vomit. He did not even vomit the aperient which was given him twenty-four hours before x-ray examination. On the majority of days definite full peristaltic waves were observed, commencing in the left hypochondrium and passing over the epigastric region into the right hypochondrium.