follows: Otitis media, 1 case; furunculosis, 2 cases; measles, 1 case; neuritis (?), 1 case; influenza, 1 case; peritonitis, 2 cases.

Their ages, counts, day of disease, etc., are given in the table. All with one exception showed a leucocytosis, the highest count being 24,000 in a four-year-old girl with furunculosis. As a rule, in the cases where a differential count was made the increase was in the polymorphonuclears. The exception to this was Case 1, twenty-two months old, who developed his otitis during his fifth week. Yet even here the neutrophiles are at the maximum and the lymphocytes at about the minimum for this age.

Case 6 presented many points of interest. His illness started apparently as a plain case of influenza, and not until his sixth day were suspicions of typhoid especially aroused. At this time his comfortable condition and prolonged fever first suggested this possibility, even though his blood on the fifth day showed 8,100 whites and a negative serum reaction. The subsequent course of the temperature and "incomplete" reactions on the seventh and fourteenth days made a diagnosis of typhoid extremely probable, even though no rose spots were ever seen nor enlarged spleen detected, nor diazo reaction obtained. His temperature reached normal on the nineteenth day.

His leucocyte count during his first three weeks, I attributed to the extensive bronchitis, which developed during the latter part of the first week. It is interesting to note that with the disappearance of his bronchitis his total white count drops to 5,000 on his twenty-seventh day, his lymphocytes go up and his neutrophiles come down (refer to table), the clinical picture of the blood in uncomplicated typhoid. The occurrence of leucocytosis, in this case due to an influenzal bronchitis, does not accord with the view that in influenza we do not get a leucocytosis. It of course may be urged that the bronchitis was not due to the b. of influenza, but to the b. typhosus or to both. It seems reasonable to suppose, however, that it was due to the b. of influenza, and that the leucocytosis was due to the same cause, namely, invasion of the system by this organism.

Three weeks after the first day of normal temperature this boy had an attack of appendicitis. The white counts at this time were 23,000, 23,600, 18,000 and 13,200 at 6 P.M., 9 P.M., 1 A.M. and 8 A.M. respectively. Notwithstanding this falling count, it was decided to operate, Dr. Bayard Holmes being the consulting surgeon. A thickened appendix was found containing a small amount of pus. Cultures showed only the b. coli communis.

It was suggested at this time that his recent illness had been due to his appendix. This seemed to me improbable, but to settle the question definitely, if possible, the urine was examined. No typhoid bacilli were found, but the para-colon bacillus was isolated. It is to be regretted that this case was not more thoroughly studied during his three weeks of fever, especially as to his urine. Was the case one of para-colon or para-typhoid infection? Does this organism, like its "first cousin," the typhoid bacillus, persist a long time in the urine? What is the significance of an "incomplete" serum reaction in cases resembling ty-

phoid? This is not the time to discuss these questions, even were I competent to do so. But in view of all the facts obtained in this case, it seems to me a reasonable doubt as to its exact nature must be entertained. I have, however, included it among the typhoids with complications, as showing an interesting behavior of the blood, whatever the cause.

Case 8, the only complicated case failing to show a leucocytosis, was severe from the start. She had hemorrhages throughout the course, and during her fifth week developed peritonitis. The typhoid infection was so severe, however, that her white count never rose above 8,400. It subsequently dropped to 4,600 on her fortieth day, death taking place four days later.

CONCLUSIONS.

The following conclusions are offered:

(1) The blood in the typhoid fever of childhood differs from that of adult typhoid only in degree.

(2) The erythrocytes are reduced in number, especially during the first three weeks, after which they begin to increase rapidly, reaching normal in the fifth week.

(3) The hemoglobin suffers more proportionately than the erythrocytes.

(4) The leucocytes are reduced throughout the first four weeks, the lowest average being reached during the second week, except in severe and tedious cases.

(5) The leucopenia is of diagnostic value, especially in children, in whom most febrile affections produce a leucocytosis. More data are needed to determine the priority of appearance of a "positive" serum reaction or a leucopenia.

(6) The relative proportion of the different varieties of leucocytes varies at different periods of the disease, the greatest variations being found in the polymorphonuclears and mononuclear elements, the former diminish and the latter increase as the disease advances. The increase in the mononuclears is chiefly in the lymphocytes. Analysis of large numbers of cases grouped by age and week is desirable.

I wish to express to my colleagues on the staffs of the Presbyterian and Cook County Hospitals my appreciation of their courtesy in allowing me to examine their patients.

REFERENCES.

1. Morse: Boston Med. and Surg. Journ., Jan. 12, 1897; Archives Pediatrics, May, 1901; Journ. Amer. Med. Assoc., Aug. 17, 1901.
- 1a. Churchill: Chicago Med. Rec., October, 1902.
2. Thayer: Johns Hopkins Reports, 1899-1900.
3. Naegeli: Deutsch. Archiv. f. klin. Med., 1900, lxxviii, 277.
4. Grawitz: Pathologie des Blutes, 1902.
5. Turk: Blut bei Acuten Infektionskrankheiten.
6. Stengel and White: Trans. Amer. Pediatric Soc., 1900, xli.
7. Cabot: Clinical Examination of the Blood, 1901.

THE CURE OF CANCER BY THE USE OF THE X-RAY.¹

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MR. PRESIDENT AND FELLOWS OF THE HAMPDEN DISTRICT MEDICAL SOCIETY: My apology for bring-

¹ Read before the Hampden District Medical Society, April 29, 1903.

ing to your attention a subject that has hardly outgrown the experimental stage is the unique field of usefulness and the vastness of possibilities it opens up to us in conquering conditions which formerly seemed hopeless.

While much has been done and more prophesied, the writings upon this subject by the various operators are very contradictory, not only as to technique but as to results. I hope in the few moments allowed me to give you a résumé of these writings, tempered with my personal experience, in the use of this new force in the past six months.

Historically you remember how, in 1895, Roentgen discovered the effect the peculiar light from a Crookes' tube had upon an ordinary photographic plate, and later the platinum-barium-cyanide screen was made, which may be fastened in the end of a boxlike affair called the fluoroscope. Much was prophesied to surgery, especially to bone surgery, and it has been all fulfilled. Even in those early days when the light at best was a flickering, uneven affair, we had something with a definite story to tell; but now with as steady a light as the sun, and one that can pierce the partitions of a building as easily as the sun enters through the glass in the window, we have evidence of the most stable kind.

What the x-ray actually is, is still an unsolved problem, but the method of control and regulation has been put quite in our power. The essentials of an x-ray outfit are: a something to furnish an electrical current at an extremely high potential, and a tube very nearly but not entirely exhausted of air, in which two plates are fastened at more or less of a distance apart.

It is in the varying conditions of these tubes that the different effects desired for different pathological conditions are found. The light from these tubes seems to be composite. It varies from a tube of high exhaustion with a bright apple-green light of great penetration, and but little irritating effect, to one of low exhaustion with a purple light with little penetration, but with a burning effect to be treated with circumspection. It is here that some have been disappointed in their work; the proper tube has not been selected. In a superficial cancer it is ineffective to put on a high or penetrating tube; and it is still more foolish to attempt to treat a deep-seated tumor with a soft violet tube, as if the treatments are long enough to be effective upon the deep tissue the ultra-violet ray present in such a quantity will severely burn the skin and underlying parts. As tubes vary with each time of excitement, it is necessary to watch them carefully. Some do this by watching the bones in the operator's own hands, but I find I have the matter more safely under my control by giving treatments in a special room for the purpose, with black walls and only artificial light, which may be entirely turned off, leaving the varying conditions of the tube very apparent. This together with the aid of the ear to one accustomed to the work makes it quite possible to measure the dose and avoid accidents.

Two methods of securing high potential electricity are in use. The one most generally used until recently was the static machine, with many large revolving plates. There were many drawbacks, such as, inability to use in humid weather, liability to breakage, amount of space occupied, etc. More

recently the Ruhmkolf induction coil has been modified so it is not only safe for the ordinary operator to use, but free from the difficulties of the static machines. Zeisler of the Northwestern University concludes that "static machines are hardly fit for dermatological purposes. A good induction coil only is to be considered." The static machine makers claim it is more liable to burn; and it certainly is, because there is more power at our command. However, there is no use in using the full current simply because it is so easy to obtain it. But it is very comforting to feel that one has reserve to use in especially resisting cases or in fluoroscopic examination of the chest, or more particularly of the pelvis. I began this work with a static machine, and saw patients get so far and then not improve. Afterwards I began to use a coil, and the results with it proved to my satisfaction there is no comparison between the coil and static machine. For all x-ray work now I use a coil which adopts the 110 volt alternating street current to its uses. Of course it is regulated and controlled by a suitable rheostat, switches, fuses, etc.

As to tube—here is the most essential part of all. The vacuum must be adapted to the case, or more or less of a failure will result. I use a chemical self-regulating tube. By this I mean one with a chemical bulb attached through which the current will pass automatically when the internal resistance of the tube becomes too great, thereby liberating in the tube a gas and thus reducing the partial vacuum. An operator must have a number of tubes on hand, as at any time, especially when the tube is high, a spark will pass through the glass walls, leaving no visible mark, but allowing air to enter and spoiling the tube. The life of a tube is variable; I presume I have excited a single tube more than a hundred times and I have broken three in a single week. Another form of tube well worth mentioning was devised by Caldwell of New York for vaginal work. It is spindle-shaped, and the cathode or target from which the rays are reflected is placed in the extreme end so that it may be introduced through a fenestrated speculum directly against the cancer. A similar device can be used in cancer of the tongue.

As to how x-ray cures, much has been said and nothing been absolutely proved. Some claim that the whole effect comes from the electrical discharges near the tube, producing chemical changes in the tissues. It is more reasonable to think that it is the Roentgen ray itself. It seems to me it is a cauterant action with a special selective action for certain pathological tissues, and which intervening tissues fail to retard to any amount; the essential features being distance between the tube and the part, whether superficial or deep-seated, and character of the tube. There is a degree of mild radiation which has no destructive action on the cancer, and possibly may be a stimulant. As we increase the power of the ray it acts as a destroyer of pathological tissue, which is eliminated as non-malignant waste product. We know how easily cancer cells break down. If the ray is still increased in force, the cauterant action is felt on the healthy structures, and death of the part results, known as an x-ray burn. These burns vary in degree in the slightest cases with simply a tanning of the skin to severe

cases in which deep sloughs occur. A peculiarity, and a distressing one, is that it takes from one to two weeks for the burn of an over-radiation to make its first appearance, and does not reach its full height for a week or so later. When the burn has reached its limit the part heals rapidly, but I have found the resulting tissue breaks down with less radiation than before. Many operators have burns upon themselves from over-exposure, and one should be careful not to expose himself to the direct action of the ray in giving treatment. I

RECURRENT CARCINOMA.—Operation eight years ago. Thirty treatments every second day.

make it a rule never to be in front of a tube longer than is needful, and in using the hand to judge of the intensity of the ray, use first one hand and then the other. With all this precaution I find the skin of my hands unduly dry and my nails exceedingly brittle.

With the proper tubes selected, and the growth exposed, the patient should be first placed in a comfortable position. Otherwise there will be a tendency to move and either get near enough to get a disagreeable shock, or disarrange the metal coverings for the healthy tissue. This covering of the healthy surrounding parts is done in several ways: block tin is used; rubber dam covered with tin foil, etc. I use ordinary tea lead lined with cloth, by

preference, silk. It is made in pads of all sizes from six inches to two feet square. The diseased part can be readily outlined with these pads, spring clothes-pins being used to hold them to the patient's clothing and to each other.

The distance of the tube from the diseased part is a very essential item. From three to twenty-four inches is the custom with an average of eight inches.

As to the immediate sensation to the patient—burn or no burn—it is nothing, except in some cases where some of the current escapes and causes slight tingling. However, when malignant tissue

RECURRENT CARCINOMA.—Operation two years ago. Return of growth one year ago. Thirty-five treatments every second day.

is being rapidly disintegrated, I have found my patients complaining of slight malaise, and in a few instances they have had a degree of fever. In one case especially, where a recurrence of carcinomatous growth of the breast was under rapid disintegration, did the patient look and feel so badly

that I feared she had another center of infection in some of the internal organs. However, this condition passed off even before the growth disappeared. It is now six weeks since I considered the cancer cured, and she has more than regained her normal condition.

As to the frequency of the treatments. At first it is best to go slowly, to see what the resistance of the patient is. On the face, from five to seven days should intervene between the treatments, gradually increasing to three or two days. On the covered parts of the body, where an accidental burn would not be so deplorable, three to five days, increasing to every second day, is the rule.

The length of exposure varies from three to twelve minutes.

The number of exposures varies, of course, with the case. My shortest case of cancer was in a breast in which the tumor was as large as a large hen's egg, and was cured in twenty treatments every second day. Another I have had under treatment for four months; at first the ulcer was four by five inches, now about the size of a silver dollar. The first case was in a person in good general health; the second was in very bad general condition, and a non-believer in drugs, so was unable to give tonics or apply proper dressings. I cite these two cases to show how much other elements enter in the time of the final result. A case may be so poorly nourished that the tissues break down easily in a burn, leaving the margin between a ray that will cure and one that will burn very small, and a man must have experience or the case will be made worse rather than better.

In regard to the comparative value of the two methods of removing cancerous growths, I do not intend to argue. If is enough to say there is a place for each. Many cases can be easier excised, while in others it is difficult to do so, or perhaps impossible. It is this latter class that have been chiefly offered for x-ray treatment—cases that for one reason or another have been allowed to go beyond the stage in which the surgeon hopes to cure.

This has been a severe test, and the results are pushing the ray from the experimental stage to one of definite therapeutical value.

However, I believe in many cases a combination of removal by cutting and radiation is the best course to pursue. In fact, in many centers of medical learning, it is the custom subsequently to removal of cancers, after an interval of ten to twenty days, to subject the patient to a number of treatments by x-ray, to eradicate any trace of cancer that may have been overlooked. No one knows better than the surgeon how difficult it is, say in a breast, to remove absolutely all the cells that may have been infected and may become a seat of infection. In this connection I quote from a paper by the surgeon Carl Beck of New York: "The Roentgen rays should be considered in the after-treatment. From the observation of Heidenhan that carcinoma cells are found below the fascia, even in apparently light cases of carcinomamammæ, we surgeons saw the necessity of removing the pectoralis major muscle, or at least its superficial stratum. In fact, no surgeon expects perfect recovery from the simple removal of carcinomatous portions, but always tries to extirpate as much of the surrounding tissues as

surgical technique permits. It is too well known that if the carcinoma cells have disseminated themselves so far that they are not accessible to the scalpel, a speedy relapse is to be expected. Now if we have a means which would, after a thorough operation, penetrate the deeper strata, so that those carcinoma cells which were situated beyond the reach of the knife would be still attacked by it, and perhaps destroyed, or at least arrested in its further development, the question of cancer would be solved."

While in this paper I only intended to speak of cancer, there are a number of other diseases from which relief may be obtained by similar use of the x-ray. Well authenticated cases of cures are recorded of favus, eczema, psoriasis, rosacea, acne vulgaris, lupus vulgaris and erythematosis, superfluous hairs, wine marks, etc. I believe the beneficial effect arises in these cases from the fact that the ray is a strong stimulant or cauterant, which, unlike any local application, has an action deep in as well as on the surface.

I will take your time to cite three cases illustrating the above:

Lupus erythematosis of the face, duration about seven years. Various methods of treatment by capable men seemed to scarcely produce even temporary improvement. Been under my care about two months, but on account of distance from my office able to come for treatment only twice a week. When first seen the ulcer or diseased area, which was triangular and about one by three inches, was covered with yellowish, slightly greasy scales, which when removed showed ulcerated bases. The diseased tissue was surrounded by many large comedones. The scales have come off in several crops, and each time they became thinner and more delicate, until at this time they are nearly gone, and the discoloration is fast disappearing. She is still under treatment.

Removal of hair.—My experience in this regard was accidental but none the less valuable. A patient with cancer of the urethra was exposed for a number of treatments to a strong ray, which reacted rather markedly on the skin over the pubes, with the result that all the hair on the side where the ray fell strongest came out and up to this time (two months) has showed no tendency to return.

Pustular eczema of the lip, duration about five years, being much worse during the winter and for a short time in the summer, so nearly well that it was not noticeable to ordinary inspection. He had received capable treatment with little or no benefit during this entire period. After I had used the ordinary ointments, etc., for a month with no decrease in the disease, I sent him to Dr. James C. White of Boston, who confirmed my diagnosis and recommended a line of treatment so nearly like that I had already used I determined instead to try the x-ray. After about eight treatments, covering a period of two weeks, quite a decided reaction was present, as seen by the darkening of the skin, swelling, heat, etc. The ray was discontinued, with the result that in ten days the part was entirely well and has remained so all winter. As he has been under the same hygienic and weather conditions as before, it is fair to assume a permanent cure, after such a period.

Almost one of the first questions we are asked,

after the curative properties of the ray have been proved to an inquirer is, Will it return? And the answer is: We do not know. Cases are on record of several years' standing, with no return. Thus far the percentage of returns is not as great as with the knife for the same period. What the final result will be only after years can tell. This I do know, that all the cases I have treated, with two exceptions, have been cases that have returned, having been cut out previously. One writer states the percentage of recurrences after operation as fifty-two. The prospect is that in thoroughly treated cases by x-ray nothing like this percentage will return. While this is the great item in judging the advantage in method, we should not forget the lack of disfiguring scar, the ease of application, not removing the patient from ordinary occupation, fear of the knife, etc.

Such facts present an argument too strong to be put aside by even the most radical operating surgeon.

Clinical Department.

A CASE OF STRANGULATION OF THE TESTIS DUE TO TORSION OF THE CORD.

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CASES of recognized torsion of the cord causing strangulation of the testicle are extremely rare.

Dr. Scudder was able to find but thirty-two cases of this condition in medical literature.

The following report presents a well-marked instance of this mishap, and the clinical symptoms were in some respects so peculiar that the case is worthy of record:

X, twenty-six years of age, vigorous and well developed, was seen by me in April, 1903. He had never had any venereal disease, nor any trouble with his testes, which were normally developed in every way.

At 10 A.M., of a Sunday, without previous injury, or other disturbing cause, he had suddenly been seized with a severe paroxysmal pain in the center of the lower abdomen, close above the pubes. He was pallid, nauseated, and was covered with sweat.

This pain was serious enough to cause him to go to bed. At 2 P.M. he vomited, after which the pain subsided so entirely that he got up at 4 P.M.

On the following morning he went down to business as usual, but soon began to suffer pain in the region of the right spermatic cord. This pain increased and extended to the testis, but he continued his occupations that day, not returning home until 7 P.M.

On Tuesday the testis was swollen, and presented all the appearance of an ordinary epididymitis, and was so regarded by his physician. The temperature, however, was at no time above 99-4° F.

On Thursday there was a decided increase of swelling and the skin over the front of the scrotum became adherent to the deeper parts. The pain

became trifling. I saw the patient for the first time that afternoon.

The right side of the scrotum was tensely swollen and indistinct fluctuation could be felt. The contour of the testis could not be accurately made out. An antiseptic fomentation was applied, and on the following morning, there being no improvement in the condition, it was decided to operate.

On cutting down, the tissues were thick and edematous. When the tunica vaginalis was opened, a very little blood-stained serum escaped. The testicle was black, mottled with plum color. The cord was tightly twisted, the rotation being from within outward. One complete turn of the testis untwisted it.

The mesorchium was not long; in fact, it was so short that it seemed rather surprising that it should have permitted so complete a rotation. The cord was wrapped tightly around it. The testicle was so evidently in a gangrenous condition that its removal was necessary. The tunica was pushed back far enough to permit access to a healthy part of the cord, which was tied in two parts and divided. The testicle was then removed. A drainage tube was placed in the tunica and the wound was closed.

Convalescence was uninterrupted, the drainage being removed on the third day.

According to Dr. Scudder's investigations, torsion of the cord produces such immediately destructive changes in the testicle that after it has existed for more than one hour, hope of saving the testis must be abandoned.

This may be true of the extreme cases of torsion where the circulation is at once and totally shut off.

If it is so, it is an exception to the rule holding in other parts of the body, for we know that the circulation may be cut off from limbs for a considerably longer time than this without endangering their life.

It seems reasonable to suppose that torsion of the cord may sometimes exist in a less serious degree than this, and it is not improbable that some of the unexplained swellings of the testicle that are recovered from may be instances of a torsion not causing complete strangulation.

A sudden attack of pain in the testicle without evident cause and without fever should arouse suspicions of this condition. Especially is this to be suspected when atrophy of the organ follows.

It would seem possible in some of these cases to undo the twist if suspected early. Unfortunately the twist is not always in the same direction. Sometimes it is from within outward, and sometimes from without inward. One can only try, therefore, by rotating the testis gently first in one direction and then in the other.

If the rotation in one direction is difficult and aggravates the pain, while twisting in the other direction is easy and relieves the pain, we may rightly presume the case to be one of torsion.

In the case just reported there were no adhesions, and it seemed as if rotation would have been possible without opening the scrotum had the condition been recognized at the outset.

Dr. Van der Poel has reported a case in which the patient had recurrent attacks of this condition, and learned how to rectify the displacement himself.