The American Journal of Roentgenology

Edited by P. M. Hickey, M. D.
Associate Editor, F. C. Zapffe, M.D.

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THE AMERICAN JOURNAL OF ROENTGENOLOGY

Editor, P. M. Hickey, M. D., Detroit
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THE DIRECT METHOD OF DIAGNOSIS OF DUODENAL ULCER BY MEANS OF THE ROENTGEN RAY

By ARIAL W. GEORGE, M. D., Boston and ISAAC GERBER, M. D., Boston

A paper entitled "Positive Diagnosis of Duodenal Ulcer by Means of the Roentgen Ray" was published by us in a recent Quarterly* of this Society.

We were led to publish this paper at this time and upon this subject for various reasons. First, because in the study of duodenal lesions in our own private practice we were led to the conclusion that we could derive certain exact data, which were constantly confirmed at operation. Secondly, we thought that if we brought this matter to the attention of our members, prior to this meeting, it might stimulate interest and enliven discussion, so that this most important subject could be thoroughly considered.

Going over the literature on the subject, we were surprised at the lack of positiveness, not only of our own colleagues, but of the foreign observers as well, and it seemed to us that the lack of exactness depended to a considerable extent upon the method used in the study; and the confusion that arose was because different investigators relied upon so-called "symptom-complexes" of hypermotility, exaggerated peristalsis, gastric stasis, relaxed pylorus, etc. The mass of evidence from the vast majority of investigators, such as Holzknecht, Haudek, Pfahler and others added to the confusion, were inferential only, and by no means conclusive.

*Amer. Quarterly of Roentgenology, 1913, IV, 187.

It is possible that we are obsessed with our own ideas, and fantastic in our conclusions; but why make such a mystery of the study of the intestinal tract or make the difficulties paramount? Does the intestinal tract vary any more in its anatomical completeness than the skeleton, lung or kidneys? Do we hesitate to recognize positively a fracture? Do we procrastinate between osteomyelitis and scorbutus? Do we hesitate to pass a positive opinion regarding kidney-stone; why then should the intestinal tract be such a bugbear to the great majority of Roentgenologists? Possibly you will all with one exclamation say, "It is not." But we can only judge from the writings of our colleagues both in this country and abroad. They seem to be united in the opinion that the Roentgen diagnosis of duodenal ulcer can only be suggestive, but not positive.

For convenience and clearness in presenting our ideas, as well as to limit the discussion of this matter to certain salient facts, which are material, I am offering you seven propositions.

First: The "positive" method (or possibly it would better please our critics and we would be considered less radical if we used the words "direct method") consists in demonstrating adequately the anatomical condition of the first portion of the duodenum. This is opposed to the conception of symptom-complexes, which we have stated

are only inferential in their evidence and are not conclusive as compared with this method in which we actually try to demonstrate the lesion.

Second: Ninety-five per cent. of duodenal ulcers occur in the first portion of the duodenum.

Third: Anatomically the first portion of the duodenum is a constant entity.

Fourth: If normal, the first portion of the duodenum can always be demonstrated on a plate, with characteristic shape and smooth outline. There is no exception to this rule. Apparent exceptions are due to improper technique.

Fifth: A constant defect in this duodenal cap means a pathological condition. This may be ulcer, adhesions, cholecystitis, or anatomical or accidental variations, such as pressure of adjacent organs, etc.

Sixth: Any duodenal ulcer, which is more than a simple mucous membrane erosion, will deform the outline of the bismuth mass. To this statement there is no exception.

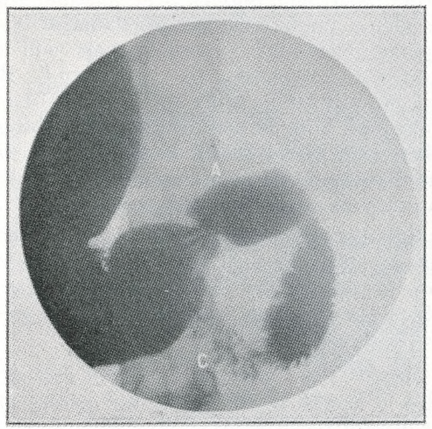


FIG. 1. Normal duodenum, taken prone. Patient weighed 125 pounds.
A—First portion of duodenum. Note the smooth contour, and absence of valvulae conniventes.
B—Second or descending portion.
C—Third or transverse portion.

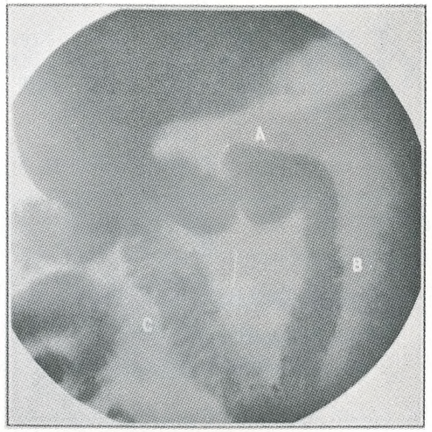


FIG. 2. Normal lateral view in a patient weighing 220 pounds. Note the resemblance to the prone view shown in Fig. 1.

Seventh: A normal "bulbus duodeni" or duodenal cap on the plates rules out indurated or surgical duodenal ulcer.

To these seven propositions I shall limit my discussion, and I trust you gentlemen will do the same. I do not wish to take this opportunity to recapitulate what was stated in our former paper. I will take up then, the first proposition, which I have stated in part. As I have said we try to show on a plate the anatomical condition of the first portion of the duodenum. No set rule can be made as to how this can be accomplished. We have used the serial method throughout our 600 bismuth cases. No criticism directed towards the serial method can deny the one most important advantage of this method and that is thoroughness; and it is because of this thoroughness that we are able to adequately demonstrate the first portion of the duodenum.

The second proposition that ninety-five per cent. of duodenal ulcers occur in the first portion of the duodenum needs no further discussion here.

Third: Upon this proposition, that the first portion of the duodenum is anatomically a constant entity, the whole value of the

application of the Roentgen Ray depends. Upon the truth or falseness of this statement the entire problem of exactness in demonstrating duodenal ulcers will stand or fall. Our conclusion is based upon the generally accepted anatomical opinion, and especially upon the researches made by Prof. Germain of the Tufts College Medical School. From the examination of the duodenum in four hundred cadavers, he came to the conclusion that the first portion of the duodenum is constant in shape, contour and general character, unless there is real disease present.

Fourth: If you will admit this proposition that it is possible with the serial method to show a normal duodenal cap when it is normal, then you have practically admitted half, if not more, of the matter under discussion. This is where the method of serial plates has a distinct advantage over the fluoroscopic method used alone or with occasional plates. It is probably true that the great majority of investigators either do not recognize or can not demonstrate a normal duodenal cap in every normal case. This is entirely a matter of insufficient or improper technique.

With the fluoroscope, and in the upright position, it is sometimes a physical impossibility with certain bismuth meals to show a perfectly well filled cap. The same frequently holds true of the prone position with any bismuth meal. We ourselves use a meal consisting of 90 grammes of bismuth subcarbonate in 500 c. c. of artificially prepared buttermilk and water. With this meal we are positive in stating that in some one of the three positions (prone, standing or lateral) by using a series of plates, we will be able to demonstrate in any given case a normal cap, if a normal cap exists. To this we claim there are no exceptions. If you will admit, as above stated, that a normal cap can be demonstrated whenever the duodenum is normal, then if the cap shows a constant defect upon the plates, the first portion of the duodenum must be pathological. By defect we mean a break in the outline, a deformity or any variation from the normal picture of a cap. We have thus narrowed our discussion down to one and really only one important problem, and that is, will all duodenal ulcers show in the Roentgen plates?

This brings us to the sixth proposition that any duodenal ulcer more than a simple mucous membrane erosion will deform the outline of the bismuth mass.

Dr. W. Mayo has recently published a pathological study of a number of ulcers excised from the anterior wall of the first portion of the duodenum.* These ulcers seemed to have a different general character from the classical callous gastric ulcers

*Annals of Surgery, 1913, LVII, p. 691.

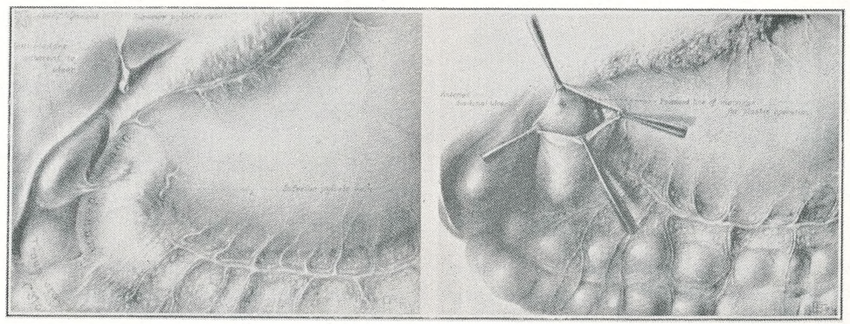


FIG. 3. Reproduction from article by Dr. Wm. Mayo.
This shows the very small mucosal defect of the duodenal ulcer, with the relatively large cicatrix extending through to the serous coat.

with which we have all been familiar. The gastric ulcers usually show a relatively broad, punched-out, callous defect in the mucosa with induration around and below. These duodenal ulcers, however, showed often merely a pin-point defect on the mucosal surface with mucous membrane heaped up around it. However, the amount of callus in the sub-mucosal, muscular, and peritoneal coats bears absolutely no relation to the minute size of the ulcer itself. Now it is not this pin-point mucosal defect that we try to demonstrate, but it is the effect on the bismuth contour produced by the extensive callus in the sub-mucosa and other layers. (See Fig. 3.)

This deviation from the normal bismuth outline is usually exaggerated; that is to say, if the callus is in itself only slight, it will still produce a bismuth deformity that is unmistakable. I believe it is fair to state that because of this exaggeration more can often be demonstrated on the Roentgen plates than can be seen by the average operator at the time of operation. In no part of the gastro-intestinal tract is the deforming effect of scar tissue upon the bismuth mass so apparent as in the duodenal cap.

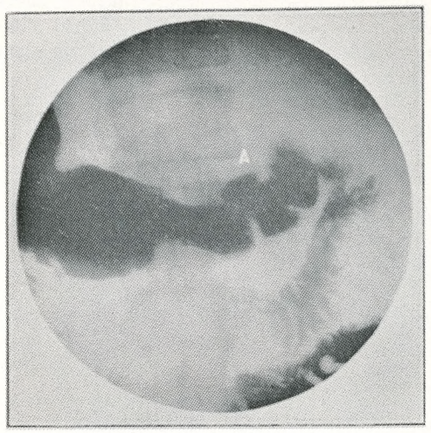


FIG. 4. Classical ulcer of first portion of duodenum, superior surface. The cicatrix extended anteriorly and posteriorly. Note incisura on inferior surface.

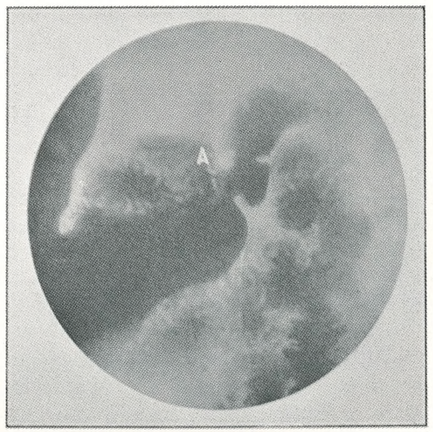


FIG. 5. A—Ulcer of duodenum. Incisura is present on opposite border.

The duodenal ulcers that consist of merely a mucous membrane erosion, of course, will not show any effect upon the bismuth, but these are an almost negligible portion of the cases and they probably give only slight and transient clinical symptoms. These are the cases, which are of no surgical consequence.

I believe, gentlemen, I have demonstrated to you the basis upon which this sixth proposition is founded.

The most severe criticism that has been made of our former paper was that it was quite impossible by our method to differentiate between adhesions due to duodenal ulcer and those due to gall-bladder disease. In some very exceptional cases it is true the differentiation may be impossible. As a rule, however, the case where adhesions are due to duodenal ulcer alone will show not only the fixity of the duodenal cap in the sub-hepatic region, but also a constant defect in some part of the duodenum due to the callus of the duodenal ulcer itself. As a rule, gall-bladder adhesions will merely show general deformity with fixation under the liver, but there will not be any one constant irregularity.

As for the differential diagnosis between adhesions due to duodenal ulcer and duodenal ulcer itself, in those cases where the duodenum is not fixed to the right, I must confess that this differentiation can very often not be made. But as far as prognosis and surgical indications are concerned, this differentiation is not at all necessary. The real point of importance in this matter is whether or not we have a lesion involving the duodenum and produced by ulcer.

This brings us to the seventh and last proposition regarding the negative value of our Roentgen examinations. In many of the cases in which we have demonstrated a normal complete duodenal cap we have passed a negative opinion upon the possibility of duodenal disease, and the case subsequently at operation has never to my knowledge been proved wrong. Even though we do not go so far as to make the statement that a normal cap means no duodenal ulcer of any kind, I think that we have at least established the authority to say positively that these cases do not warrant surgical interference so far as possibility of duodenal ulcer is concerned. I believe that a big half of the value of Roentgen evidence is in the negative aspect, and this negative evidence has even greater value in the duodenum than in the stomach.

From what I have said, gentlemen, it is evident that this whole subject depends prac-

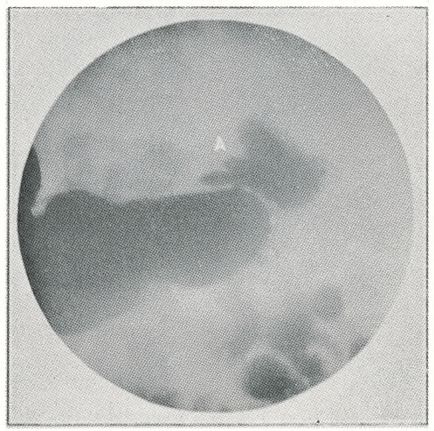


FIG. 6. More extensive cicatrix, causing a greater deformity of the duodenal cap.

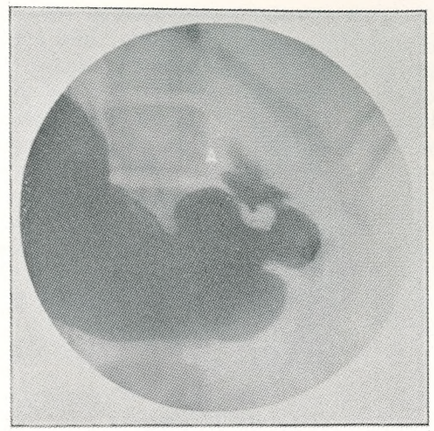


FIG. 7. Extensive ulcer of first portion of duodenum. Plate taken with patient lying prone.

tically upon two important points; first, the ability to demonstrate completeness of the first portion of the duodenum and secondly, the demonstration either of a normal cap or of a constant defect. There is no better defence for serial radiography than the fact that we can bring out just these points. We know that the fluoroscope has not accomplished it and we know that some men are doing this work by means of repeated plates. I believe that I have sufficiently represented my attitude upon this problem and I therefore leave these propositions in your hands for further discussion.

Since the above paper was read before the American Roentgen Ray Society by Dr. George, we have had 18 more operated cases of duodenal ulcer. This number, added to the previously reported 59 cases, makes a total of 77 operatively proved cases of duodenal ulcer. We have already reported three minor errors of diagnosis, no one of which was a serious error. In the entire series we have had but one real failure of diagnosis. This was a case in which a large series of plates showed a persistently deformed duodenal cap in the prone position. However, one lateral view showed a definitely normal cap. During

FIG. 8. Same patient as Fig. 7. Lateral view.

the discussion of the diagnosis with the surgeon, this lateral view was entirely ignored, and a positive diagnosis of ulcer was made. At operation the duodenum was found normal, but there was a chronically inflamed appendix. This had probably produced a pyloric or duodenal spasm resulting in the incomplete filling of the duodenum. This was a case in which the mistaken diagnosis was due, not to any deficiency in the Roentgen method, but to careless interpretation. The plates themselves did not lie. Sufficient attention should have been paid to the normal appearance of the duodenum in the lateral view.

At this point we feel that it is proper to reiterate our ideas on the importance of the lateral view in bringing out the anatomy of the duodenum. This position has a distinct indication in two types of cases.

The first group is where there is an irregular, incomplete filling of the duodenal cap. Here the possibility of spasm is always present. The one means at our command to rule out this condition is the lateral view. This method of examination of the duodenum requires a very careful attention to the technique. Unless care is taken the plates will be blurred, indistinct, and worthless. The patient lies on his right side upon a plate, usually of the 10″ x 12″ size. It is advisable to use the smallest diaphragm and cone obtainable. The writers use a diaphragm 1½ inches in diameter, and a cone 6 inches long This is brought practically in contact with the left side. The exposure must be slightly longer than is required to give a satisfactory plate with the same patient in the prone position. If this technique is carefully followed out, a satisfactory lateral view can be obtained in practically every case. As a rule, in stout people the lateral view is easier to obtain than with thin subjects. By means of this method the antrum of the stomach and the first portion of the duodenum are in the most dependent position. We thus get the effect, not only of the peristaltic force of the stomach muscles, but of the force of gravity as well. These two forces acting together will usually relax the spastic pylorus and duodenum, so that the normal contour of the duodenum can be demonstrated. Sometimes it may be necessary for the patient to lie upon his right side for a considerable length of time before the spasm is released. This explains why a normal cap was finally shown in the case above described where

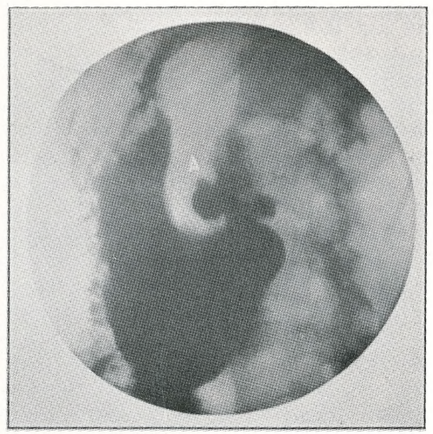


FIG. 9. Same as Fig. 8. Plate taken 20 minutes later. Note the almost exact reduplication of the deformity in the duodenal cap.

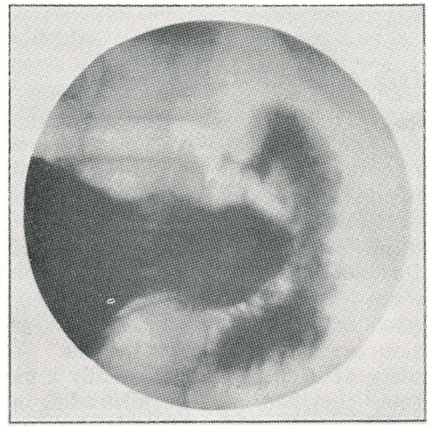


FIG. 10. Very extensive ulcer causing almost an entire obliteration of the first portion of the duodenum.

the incorrect diagnosis of duodenal ulcer was made.

The second class of cases in which the lateral view has a distinct application is that group where the pyloro-duodenal region cannot be properly demonstrated in either the prone or standing positions. To this group belong practically all stout patients. In these people the increased intra-abdominal pressure causes the so-called "steer horn" stomach with the right-sided position of the antrum and duodenum. In such stomachs, it is usually impossible to demonstrate the pylorus and duodenal cap in the prone position. When standing the bismuth will usually precipitate in the duodenal cap so as to make the complete filling of the duodenum likewise impossible. In such cases, the lateral view is very satisfactory.

Figure 2 shows a lateral view of a very stout man in which all three portions of the duodenum are very definitely and beautifully demonstrated. We believe that the lateral view should be used as a routine in every stout person, for in no other way can the duodenum be so adequately shown.

259 Beacon Street.

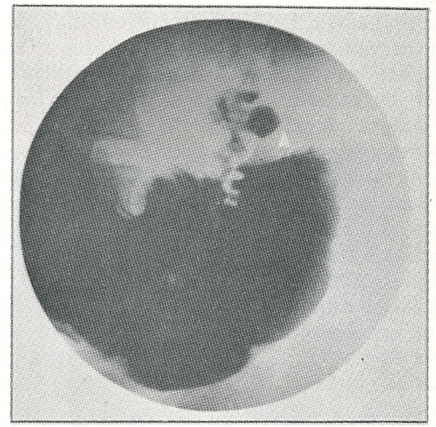


FIG. 11. Extensive duodenal ulcer with secondary dilatation of the stomach. Note the sacculation produced by some of the adhesions.

ROENTGEN EXAMINATIONS FOR HEAD INJURIES

By A. L. GRAY, RICHMOND, VA.

To no exposed part of the human anatomy is traumatism followed by results so uncertain, as to the cranium. Injuries apparently trivial often produce the gravest consequences while the converse is also not infrequently true.

The opinion of the Roentgenologist is more relied upon by the surgeon in cranial examinations than in almost any other of the diagnostic fields of Roentgenology, and the necessity for accuracy in technique and conclusions is plainly evident. The importance of examining the skull after injuries of only moderate severity has so often been impressed by the Roentgen findings that it needs no comment in advocacy thereof. Permit me to say, however, that in infants and very young children the thinness of the cranial vault renders injury to the intracranial structures far more liable than in adults, and the damage often escapes detection until some serious manifestations appear in later life. It seems entirely reasonable to conclude that permanent injury often results from the carelessness of a nurse, who, on her daily trips to the park, having forgotten her charge by reason of the attentions of the ever present suitor, is awakened from her dreams by the cry of the little one who has tumbled from the bench or has pitched head first from its carriage to the pavement beneath. Such injuries as these are usually never reported to the parents, and the abrasion or contusion, if noticeable, is explained in some other plausible way. The convulsions and palses that come on later are called idiopathic or are attributed to birth trauma and the true cause remains forever unknown.

In injuries of greater severity it is very common for the patient to be rendered immediately unconscious, and perhaps, in a few hours the mind clears and the attending physician dismisses the case as one of "concussion of the brain." The real nature of the injury may or may not be revealed later. Unfortunately fracture of the skull usually does not give rise to focal signs that can be detected, and inspection, palpation, and percussion are very imperfect guides. The presence of haematomata is usually a most valuable sign, but may be misleading and often in extensive fractures this sign is entirely wanting. The value of the Roentgen examination should be not alone in ascertaining whether or not a fracture be present, but, in the absence of other determining factors, in enabling the surgeon to decide whether or not an operation is indicated and the site and nature of the operation if it is deemed advisable. If craniotomy be considered unnecessary, the permanent record of the Roentgen plate will be a guide for a future operation, should the subsequent history of the case demand it.

For accuracy in the diagnosis the sharpest possible detail is demanded. Unless this be obtained, a definite exclusion of fracture can not be made. To exclude fracture the plates should show plainly the bone structure, sutures, and fine grooves for the smaller branches of the epi-dural and diploic vessels. In the very young, where the grooves are too faintly marked, the outline of the skull should be sharply cut throughout, and all the sutures clearly visible.

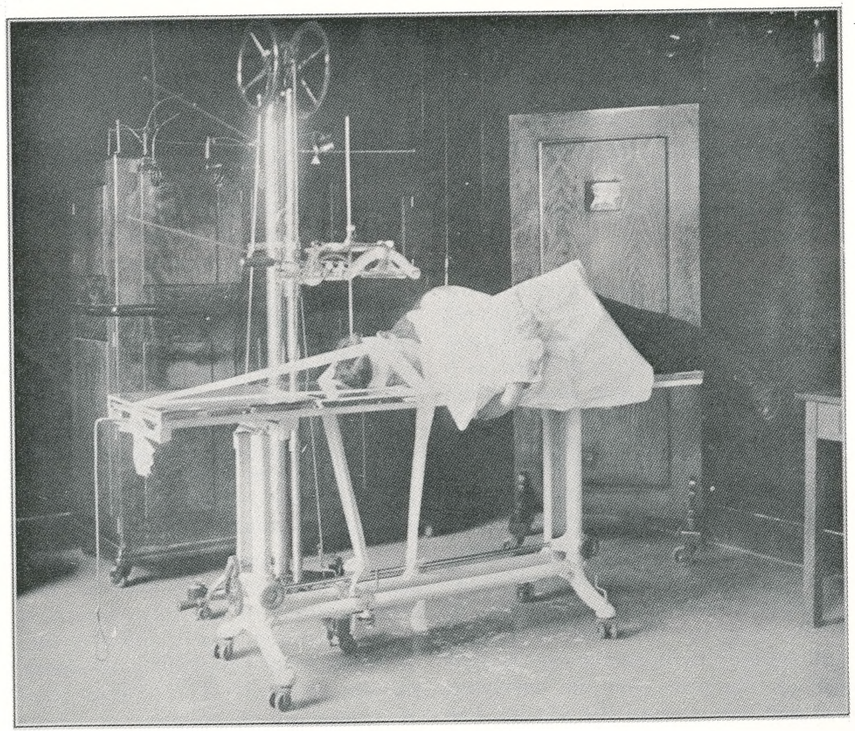
The difficulty of obtaining detail in plates of supposed head fractures is familiar to all of us who are connected with emergency hospitals. The patient is usually not only unable to give intelligent assistance, but oftener than otherwise, resists all efforts to keep his head still. The ingenuity of the operator and his assistants is sorely taxed.

It is especially difficult to obtain sharp stereoscopic plates, since the time required in exposures and shifting must be from 2 to 8 seconds, and all the usual braces and weights must be discarded. The motion of respiration and even the cardiac impulses must be overcome.

Of the methods devised for surmounting these obstacles I wish to mention the use of sand bags against the chin or chin and nucha, padded clamps, and a modified lateroprone position with the upper shoulder supported so as to allow free antero-posterior movement of the chest in respiration.

In children it is often possible to make a quick single exposure at the end of expiration, and in adults I have taken advantage of the long pause in the Cheyne-Stokes type of respiration that is not infrequent when the injury is grave.

I have employed recently a very simple and effective method of holding the head still without the use of clamps, weights, or other apparatus that might tend to interfere with the interpretation of the plates. I use two or more lengths of gauze bandage 2½ or 3 inches wide, and loop the middle of one of them around the patient's head, fastening the free ends to some suitable fixed portion of one side of the table. The second bandage is correspondingly placed with the free ends toward the opposite side. The head is thus pulled from two opposite directions and when the tension is sufficient to stop all movement, the free ends of the second bandage are securely tied to the table. If these two are found insufficient without exerting too great force, a third bandage is looped under the chin and fixed at the head of the table. Should the table be so con-



Illustrating Dr. Gray's Method for Stereoscopic Examination of Skull

structed as not to furnish convenient fixed points for the attachment of the bandages, I employ heavy sand bags to which the free ends of the bandages are tied. There is thus afforded support from all sides and perceptible motion is usually entirely abolished. The transparency of the bandages permits the making of head plates unmarred by extraneous objects. In some of my sharpest plates I have given an exposure of as much as ten seconds while the patient's respiration proceeded normally.

Since the extent of a cranial injury can be determined far more accurately by the stereoscope, whenever possible this method should be pursued, but if detail is not practicable it is necessary to make single plates from several directions.

The position of the head for the Roentgen examination is usually suggested by the presence of contusions or other marks of violence, but these are by no means always present. This is often true of fractures about the base where the injury has been produced by indirect violence. The usual bleeding from the ears, nose or eyes is not a constant accompaniment.

By far the greatest amount of information may be obtained from a stereoscopic examination made with the head placed on one side with its mesial plane parallel with the plate. The target should be in a vertical line through the bregma, and the tube should shift transversely with this line as a center and at a distance not greater than 22 inches from the plate. This position not only shows the vault clearly but also admits of a better view of the base. In the absence of guiding factors, an examination thus made will prove most advantageous.

The best position for plates of definite portions of the skull will suggest itself readily to the experienced Roentgenographer. A general rule, however, that may be applied is, attempt not only to throw the part in such a position on the plate that the overlying structures will not confuse the picture, but so place the head and direct the rays that the region sought will stand out as conspicuously as possible.

For a correct interpretation of the plates it is clearly necessary that the Roentgenologist should be thoroughly familiar with the normal grooves and depressions in the skull. The presence of exaggerated Pacchionian depressions has occasionally caused a considerable degree of perplexity in injuries supposed to have been produced by puncturing bodies. The development of the skull and the presence of Wormian bones and the sutures surrounding them should be held in mind especially in the young, lest they lead to a misinterpretation. Perhaps the most difficult fracture of the vault to recognize is one occurring in the groove for the trunk of the middle meningeal artery. If a linear fracture is confined to this groove, it is questionable whether it can be recognized. Diploic veins especially the anterior and posterior temporal often produce very marked thinning of the bones along their courses and may be mistaken for fractures.

In one case in my experience a linear fracture followed the course of an abnormally large diploic vein. Upon operation it was found that the outer table only was involved. It may be generally stated that, if the plate throughout shows no blurring, a fracture line will appear sharply cut and with characteristic angles and irregularities, while a vessel groove or canal shades from its center to the edges and disappears into the adjacent bone.

Having determined the presence and extent of a fracture, the Roentgenologist is frequently called upon by a surgeon for advice as to the course to be pursued by him. The special points to be considered are:

1. The Location. This should be considered both as regards probable damage to vital portions of the intra-cranial contents by the causative injury and also the degree of traumatism entailed by an operation at the site involved. The location should also be considered in relation to extra-cranial structures especially the nasal, pharyngeal, and auditory cavities in regard to the probability of infection through compound wounds.

2. Shape. Whether linear, circular, stellate or of a jagged and irregular course. These points will, to a great degree, aid in determining probable localized pressure from depressed fragments.

3. Size of the fissure, or the amount of separation of the edges of the fragments, which also gives an idea of the probable damage to the soft tissues as well as the possibility of hernia or excessive scar tissue at the side of the wound.

4. Course, as to the probability of damage to blood vessels, nerves or other important structures.

5. Whether the margins are overlapped or are dodging each other. From consideration of these points we may obtain valuable information in estimating the extent of the fracture, the injury to soft structures and the degree of compression.

6. Age. By reason of the thinness and pliant condition of the skull of an infant, it is probable that a marked degree of accommodation may take place resulting in perfect compensation or complete return to the normal. A blow that would cause a depressed fracture in the adult will often produce an indentation without fracture in the very young child. In such cases, intra-cranial pressure alone may obliterate the depression. The possible interference with cerebral development at the site of the injury, however, should be carefully weighed. The patency of the fontanelles is to be considered in operations for general decompression. Nature's method of relieving the situation may leave less scar tissue and close in the cranial orifice far more perfectly than the most skilful surgeon.

Finally it is very important that the Roentgenologist should follow his patient to the operating table taking with him the plate or an accurate diagram of the conditions. He should, if possible, remain throughout the operation to see that the impressions he has received are also in the mind of the operator.

312 E. Franklin St.

SLIDES

1. Showing detail. Jones. Hematoma.
2. Same. Headon. Fracture Mastoid.
3. Sand bag against chin only. Thompson child. Fracture extensive and dodging.
4. Padded sand bags. Bigger. Fracture Occipital bone.
5. Padded clamps. Malcom. Multiple cracks. Aeroplane case.
6. Shoulder supported. No other fixation. Moorefield.
7. Quick exposure at end of expiration. Nash child, crying. Dent in frontal bone.
8. Interval of Cheyne-Stokes respiration. Hoagland. Extensive gaping fracture of parietal.
9. Illustrating also separation of margins. Sack. Fracture of parieto-temporal region to parieto-occipital suture.
10. Illustrating head held in position.
11. Same showing centering rod over bregma.
12. Radiograph of same head immediately after last photo. (One of stereoscopic pair.)
13. Same case as No. 1. Stereoscopic with head fixed by bandages.
14. Exposure of 8 seconds. One of stereoscopic pair, head fixed by bandages Dr. Clark.

SOME EXPERIMENTS IN STANDARDIZATION OF DOSAGE FOR ROENTGEN THERAPEUTICS

By GEORGE W. HOLMES, M. D., Boston, Mass.

Ever since the discovery of the therapeutic action of the Roentgen ray upon certain pathological processes, attempts have been made to accurately measure the amount of rays required to produce best and quickest, the desired changes. Advance of work in this field has been greatly delayed by the lack of efficient apparatus. Fortunately during the past few years, considerable improvement in machines for the production of the rays has been made. It was to take advantage of these recent improvements, especially those of the type of apparatus now in use in the Massachusetts General Hospital, that this work has been undertaken. Efforts toward the measurement of X-ray dosage have in the past been directed along two lines: First, attempts to measure the amount of electrical energy delivered from the Roentgen tube during the time of exposure which produced the desired effect. Second, by placing between the tissues being treated and the excited tube certain chemical substances which undergo changes when exposed to x-light, and from the amount of change in these substances, to judge the amount of dose to the tissues being treated.

It is evident that the first method is almost entirely dependent on the degree of perfection of the apparatus used, while the second is independent of apparatus—accuracy depending upon the ability of the operator to judge slight chemical or color changes.

In comparing these methods, two questions arise which must be answered before the relative value of either method can be determined. First, is the amount of change produced in living tissues in direct proportion to the amount of electrical energy dissipated? Second, does the amount of change taking place in certain substances when exposed to x-light always maintain the same proportion to the degree of change taking place in living tissues?

In an attempt to answer these questions, the following experiments were undertaken:

The apparatus used to excite the tube was a type of transformer capable of generating a non-fluctuating voltage with a current of from one to one hundred and fifty milliamperes, with a voltage on the tube terminal of from ten to eighty kilovolts, and equipped with instruments for measuring these variations in milliamperes and volts.

We first made a series of exposures upon photographic plates to determine whether or not the amount of chemical action as recorded was or was not in direct proportion to the electric energy delivered through the tube measured in watts. Plates were exposed in the following manner: An 8x10 plate was divided into two equal parts, each one of these parts was further divided into five equal parts. All divisions, except the one being exposed, were then covered with lead sufficient to prevent the passage of any rays. Five exposures were made over one-half of the plate starting with forty kilovolts, and increasing with each exposure up to eighty kilovolts (the amperage and distance being constant). The other half of the plate was then given five exposures, keeping the voltage and distance constant, but increasing the amperage at each exposure. The plate was then developed and the amount of chemical change taking place with each exposure as shown by variation in color of the different divisions compared. It was found that where the wattage was the same, the colors matched. This experiment was repeated many times, varying the amount of energy used for the series—so that plates were obtained of different photographic values,

also with different tubes of the same make and with tubes of different makes—tubes having tungsten, platinum and silver targets. The result was always the same. It was also noted during these experiments that the amount of photographic action could be doubled either by doubling the voltage or the amperage, and that the amount of heat generated in the tube was apparently directly dependent upon the wattage, i. e., tubes of high voltage became hot sooner than tubes of low voltage passing the same amount of amperage.

I have stated that the results of the experiments were the same no matter what type of tube was used. This is true in so far as areas receiving the same wattage with the same type of tube always showed the same degree of color change, but when plates taken with tube having tungsten target were compared with plates taken with tubes having silver target, a distinct difference was noted in the amount of color change produced by the same wattage in a given period of time. This was expected, as it is well known that the character of the rays changes somewhat with the character of the metal composing the target—metals of low atomic weight giving rays of less penetrating qualities than those given off from the metals with higher atomic weight. In the remaining work, tubes with tungsten targets only were used.

We then began to make careful records of the voltage, amperage, distance and time of exposure used in all treatments given—as far as possible the same voltage was used for each case throughout, it being varied with different cases. A standard distance of ten inches was used. When an erythema was obtained the total amount of wattage and time were computed. After a sufficient number of these record charts had been obtained, it was possible to arrange a comparatively accurate table of doses, showing the number of milliamperes, kilovolts and time of exposure necessary to produce an erythema of the skin with a tungsten tube at a distance of ten inches. These doses were then given at a single sitting in selected cases and the results noted.

From the study of the results in these cases, it was possible to correct the table so as to eliminate any errors due to long duration of treatment.

A study of the completed table showed that the following factors must be considered in giving an erythema dose: time, amperage, voltage and distance—all of which are in accord with past experience—but it was also found that the higher the voltage used, the shorter the time required to produce a reaction. We had up to this time believed the opposite to be true, i. e., that low tubes were more dangerous than high ones.

TABLE OF DOSAGE.

Kilovolts	Milliamperes	Minutes	Inches
40	5	15	10
50	5	12	10
60	5	10	10
70	5	8	10
80	5	7	10

If the results from this table are compared with the results made from the photographic plates they will be found to be the same, namely, the amount of change taking place on the photographic plate and the amount of change taking place in the skin were both in direct proportion to the amount of electrical energy delivered through the Roentgen tube measured in watt seconds.

In order to compare these results with those of previous workers and to test the value of the pastille as a means of measuring dosage, a series of experiments were undertaken using the Sabouraud pastille, the Hampson radiometer and the Holznecht radiometer. Treatments were given according to the table previously described. The pastille was placed in position enclosed in black paper and exposed throughout the treatment. Only cases where a full erythema dose was to be given were used. At the end of the sitting, the pastille was examined and the dose as recorded by it charted. It was soon seen that the dose recorded by the

pastille was too little with low voltage and too much where a high voltage was used.

Further work showed that to have the two methods agree, the dose had to be given at about sixty kilovolts, i. e., with the tube reading between 6 or 7 Benoist—the only degree of hardness where the dose is accurately measured by any of these instruments. The same results were obtained with the three types of pastilles used.

The necessity for using a tube of certain degree of hardness when using the pastille as a measure of dosage has been observed by previous writers.

Is it not possible that in the present technique where large doses of very hard filtered rays are given (measured by the pastille) that the dose is actually less than where the soft unfiltered rays are used, and that the good results obtained by this technique are due not to the supposed larger dose but to the special action on or adaptation to the case being treated of the high voltage ray? Furthermore, is it not possible with correct measurement of these high voltage rays either by the method described or with a color scale corrected for high voltages, to give much larger doses than are now being given, without danger of burns?

With this idea in mind, we attempted to carry out a series of experiments, using rays of different voltage in the treatment of different pathological conditions.

It is of course evident to anyone who is familiar with the laws of absorption of x-light that the distance to which the lesion extends below the surface or at which it is situated, must determine to a considerable extent the voltage of the rays used, regardless of the nature of the disease being treated.

We were unable to complete these experiments on account of the large amount of material required and the inability of our apparatus to deliver rays at very high voltage. We hope, however, with improved apparatus to make some definite statements along this line of treatment in the future.

During the past year we have given at the Massachusetts General Hospital and in private work, thirteen hundred and eighty-one treatments, in which as far as possible the method of dosage described in this article was used. The average number of treatments per case were seven, and the number of cases treated, one hundred and ninety-seven. Of these, seventy-four showed a distinct reaction, and ten of the reactions followed single massive doses. In no case was there any bad effect due to over-dosage.

Appended is a tabulated list of the cases treated, with the results obtained.

CONCLUSIONS: First: The amount of chemical or biological action produced by the x-ray is in direct proportion to the amount of electrical energy supplied to the tube which produces the ray. Second: With modern apparatus, it is possible to measure this energy with sufficient accuracy to use it as a basis for a table of doses. Third: The results obtained with this method seem more accurate and are more easily applied than any other. Fourth: The possibility of giving accurate dosage with rays of widely varying degrees of penetration and of testing their value in different pathological conditions is made possible. Fifth: The high voltage or hard ray may be more dangerous than low voltage or soft ray.

In closing, I wish to thank Dr. Walter J. Dodd for his constant help and advice.

Number	NAME	DIAGNOSIS	Number of Treatments	Duration of Treatment	Average voltage used in kilovolts	Average number of milliamperes (min) given at each sitting	Total dosage received in milli-amperes (min)	Dose received before a reaction obtained	REMARKS
1	Mr. B.....	Epithelioma of 3rd finger, right hand	2	28 ds.	50	25	50	...	Improved.
2	Mr. B.....	Epithelioma, left side face.....	5	5 mo.	60	12	.....	...	Cured.
3	Miss B.....	Carc Breast.....	14	6 mo.	60	25	.....	...	Did not return.
4	Mr. B.....	Giant cell sarcoma tibia.....	14	8 mo.	70	50	.....	...	Improved.
5	Mrs. C.....	Carc Breast.....	21	2 mo.	60	30	.....	...	Did not return.
6	Mrs. C.....	Carc Breast.....	21	5 mo.	60	25	.....	...	Did not return.
7	Mrs. C.....	Carc Breast.....	9	2 mo.	60	25	192	...	Improved.
8	Mrs. D.....	Carc Rectum....	2	3 ds.	60	25	.....	...	Improved.
9	Mrs. D.....	Epithelioma, back of ear.....	1	.....	60	25	.....	...	Improved.
10	Mrs. D.....	Carc Breast.....	15	4 mo.	60	25	.....	...	Improved. Still treating.
11	Mrs. D.....	Carc Breast.....	1	.....	60	25	.....	...	Did not return.
12	Mrs. E.....	Carc Jaw.....	4	13 ds.	70	25	.....	...	Did not return.
13	F. C. F.....	Malig lymphoma.	29	1 yr.	65	25	.....	...	Cured.
14	Miss F.....	T. B. Glands.....	3	14 ds.	70	25	75	...	Improved.
15	Mrs. F.....	Carc Breast.....	18	7 mo.	70	25	....	R	Improved. Still treating.
16	Mrs. F.....	Tumor side of face	2	7 ds.	75	25	.....	...	Much improved. Still treating
17	Mrs. F.....	Epith Face.....	4	2 mo.	50	30	65	...	Cured.
18	Mrs. F.....	Carc Breast.....	16	5 mo.	50	25	.....	...	Improved.
19	Mr. F.....	T. B. Skin.....	7	4 mo.	60	30	185	...	Very little improvement.
20	Mr. G.....	Carc Breast.....	18	3 mo.	60	25	....	R	No improvement.
21	Miss G.....	Carc Breast.....	1	.....	60	30	.....	...	.....
22	C. H. H.....	Leukoplakia.....	1	.....	60	15	.....	...	Did not return.
23	Mrs. H.....	Carc Jaw.....	14	2 mo.	50	25	.....	...	No improvement.
24	Mrs. H.....	Malig Rectum...	14	1 mo.	60	25	.....	...	No improvement.
25	Miss H.....	Tuberculosis	2	7 ds.	60	25	.....	...	No improvement.
26	Mrs. H.....	Carc Breast.....	13	6 mo.	65	25	.....	...	Improved. Operation advised.
27	Mr. H.....	Epith Ear.....	14	5 mo.	60	25	....	R	No improvement.
28	Mrs. H.....	Epith left side face	5	4 mo.	60	25	...	70	Improvement.
29	Miss D.....	T. B. Glands, neck	15	6 mo.	60	25	300	65	Much improvement.
30	Mr. G.....	Psoriasis of Leg..	20	14 mo.	40	...	.....	...	All lesions healed promptly, but returned. Treatm't repeated.
31	Mrs. B.....	Rodent Ulcer right eyelid.....	8	3 mo.	60	...	.....	65	Lesion cured.

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32	Mr. J.	Epith, eyelid	5	2 mo.	50	30	....	...	Improved.
33	Mr. K.	Adenocarcinoma..	38	6 mo.	80	25	....	...	Improved.
34	Mrs. F.	Carc Breast	6	1 wk.	60	25	....	...	.....
35	Miss F.	Carc Uterus	4	1 mo.	60	25	....	...	Did not return.
36	Miss McD.	Carc Breast	8	1 mo.	50	25	....	...	Improved.
37	Mrs. M.	P. O. Breast	15	1 yr.	50	25	....	...	Improved.
38	Miss M.	Intest Sarcoma	18	10 mo.	50	25	....	...	Improved.
39	M. O.	Lupus Vulg	4	10 ds.	50	30	140	...	Did not return.
40	M. O.	Psoriasis	4	1 mo.	30	20	140	...	Did not return.
41	D. O.	Sycosis	7	6 mo.	50	60	415	110	Cured.
42	O. P.	Epithelioma	5	3 mo.	60	30	155	105	Much improved.
43	P.	Painful Scar	3	3 wk.	60	30	105	...	Did not return.
44	G. P.	Leukemia	18	2 mo.	60	30	425	...	Still treating.
45	E. P.	Epithelioma	2	1 wk.	45	35	70	...	Did not return.
46	R.	Epithelioma	4	2 mo.	70	25	100	...	Still treating.
47	R.	Delayed resolution	2	3 ds.	50	30	60	...	Result not obtained.
48	J. R.	Keratosis of hands	4	1 wk.	50	30	120	...	Did not return.
49	M. R.	Sycosis vulg	1	.....	55	65	65	65	Def. reaction. One month complete. Epilation over exposed area.
50	J. R.	Epithelioma	2	2 ds.	35	25	55	...	Lesion entirely healed.
51	C. G. R.	Hodgkins Dis	6	1 mo.	50	35	250	R	Did not return.
52	E. R.	Psoriasis	2	3 ds.	65	40	85	85	Decided improvement.
53	J. R.	Pruritis	1	.....	60	15	15	...	Did not return.
54	P. S.	Thymus	1	.....	50	60	60	...	Did not return.
55	A. S.	Sycosis vulg	3	1 mo.	50	30	115	55	Lesions practically cured.
56	E. S.	Erythema indur..	12	1 mo.	50	30	318	...	Improved.
57	E. S.	Herpes zoster	2	1 wk.	50	35	70	70	Improved.
58	A. S.	Thymus	3	1 mo.	50	30	100	...	Improved.
59	S. S.	Erythema indur..	3	2 wk.	45	20	55	...	Lesions practically cured.
60	C. S.	Epithelioma	4	2 wk.	50	20	105	...	?
61	E. S.	Cicatric burn	4	1 mo.	60	25	130	60	Still treating.
62	F. S.	Phthisis	1	.....	80	40	40	...	Did not return.
63	J. S.	Hodgkins Dis	54	11 mo.	?60	15	1044	240	Skin tanned. Spleen still large. Otherwise well.
64	C. S.	Hyperhydrosis	6	1 mo.	60	25	155	...	Improved.
65	A. S.	Carcinoma	9	5 mo.	60	30	191	131	Improved.

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66	E. S.	Sycosis	1	.....	50	45	45	45	Improved.
67	J. V.	Adenoma	2	1 wk.	50	15	45	...	Did not return.
68	W.	Lup vulv (sebac)	3	1 wk.	40	20	70	70	Improved.
69	J. W.	Keloid	5	1 mo.	60	50	215	125	Improved. Still treating.
70	B. W.	Eczema	3	2 wk.	40	30	80	...	Did not return.
71	A. W.	Epithelioma	4	7 mo.	50	30	125	125	Did not return.
72	A. L.	Hodgkins Dis	2	1 da.	65	25	50	...	Did not return.
73	L. L.	Epithelioma	10	3 mo.	50	20	210	90	Very much improved.
74	C. L.	Hydrosis	1	.....	30	50	50	...	Did not return.
75	A. L.	Keloid	7	3 mo.	50	30	148	...	No improvement.
76	A. L.	Eczema	6	1 mo.	60	30	149	149	Improved.
77	E. L.	Tuberculosis	1	.....	60	24	24	...	Did not return.
78	J. L.	Sarcoma	10	3 mo.	60	30	320	140	Improved. No evident tumor present.
79	F. L.	Chr eczema	12	7 mo.	35	25	230	105	Improved.
80	E. L.	Lichenplanus	12	5 mo.	30	30	235	190	Slightly improved.
81	T. L.	Hodgkins Dis	55	10 mo.	50	25	1221	140	Slightly improved.
82	A. L.	Thymus	3	11 ds.	45	30	145	...	Did not return.
83	P. L.	Thymus	3	11 ds.	45	25	85	...	Did not return.
84	P. M.	Recur Carc	3	12 ds.	60	30	115	...	Did not return.
85	C. M.	Pruritis	1	.....	80	15	15	...	Did not return.
86	J. M.	Psoriasis lich	6	2 wk.	60	30	205	185	Improved.
87	R. M.	Itching Dis	4	4 ds.	50	30	90	...	Did not return.
88	T. E. M.	Sarcoma	5	6 wk.	40	20	155	...	Did not return.
89	E. McC.	Furunculus	1	.....	50	20	20	...	Did not return.
90	C. McC.	Epithelioma	5	6 wk.	60	20	105	75	Did not return.
91	McC. M.	Epith (?neck)	14	4 mo.	60	30	317	123	Improved.
92	E. McF.	Pruritis	1	.....	...	45	45	...	Did not return.
93	J. McG.	Ulcer, right eye	3	3 wk.	60	25	70	...	Still treating.
94	M. McL.	Exoph goitre	1	.....	60	50	.....	...	Still treating.
95	I. McN.	Epithelioma	4	2 mo.	40	30	150	90	Doing well. Did not return.
96	G. M.	Scrofuloderma	4	5 wk.	30	25	125	...	Did not return.
97	L. M.	Epithelioma	2	8 ds.	55	35	70	70	Lesion apparently cured.
98	J. M.	Folliculitis	5	4 mo.	45	30	195	50	Improved.
99	K. M.	Epithelioma	4	2 mo.	40	30	160	130	Healed.
100	A. M.	Tuberculosis	7	2 wk.	60	20	145	...	Improved.
101	M. M.	Epithelioma	4	3 wk.	50	25	100	100	Wound healed.

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102	A. M.	Favus	4	1 mo.	40	25	157	...	Result excellent.
103	J. N.	Melanotic sarc...	33	9 mo.	60	30	835	306	Superfic blister, practically cured.
104	J. N.	Dermatitis	10	4 mo.	40	30	290	...	Improved.
105	J. E.	?Thymus	1	.....	...	...	25	...	.....
106	V. F.	?Thymus	3	5 wk.	20	20	65	65	Marked improvement.
107	E. F.	Favus	1	.....	30	50	50	50	Epilation complete.
108	W. F.	Epithelioma	2	1 wk.	...	30	60	...	Did not return.
109	J. F.	Sarcoma	11	6 wk.	50	25	275	...	No improvement.
110	H. F.	M lymphangioma	1	.....	60	20	20	...	Did not return.
111	K. F.	Mycosis fung	23	4 mo.	60	25	619	619	Improved.
112	A. F.	?Enlarged glands.	18	1 mo.	50	20	435	...	Improved.
113	M. F.	Enlarged thymus.	2	1 wk.	60	20	45	...	Still treating.
114	N. G.	Eczema	4	7 wk.	50	20	90	...	Improved.
115	Mrs. G.	Carcinoma	9	2 wk.	60	20	210	30	Much improved.
116	D. G.	Epithelioma	4	2 wk.	45	15	80	80	Lesion healed.
117	J. G.	Sycosis	2	3 mo.	35	50	118	100	Good result. Much improved
118	H. G.	Favus	2	3 ds.	40	30	80	80	Part epilation obtained.
119	B. G.	Hyperthyroidiza-	6	3 wk.	60	30	125	105	Marked improvement.
120	S. G.	Pyogen folliculi-	2	2 wk.	50	35	92	...	Did not return.
121	M. H.	Epithelioma	1	.....	60	25	25	...	Did not return.
122	C. H.	Lymph leukemia..	2	2 wk.	65	30	30	...	Did not return.
123	C. H.	Epithelioma	19	5 mo.	60	20	363	...	Improved.
124	A. H.	Pruritis	2	1 da.	40	35	75	...	Did not return.
125	A. H.	Pruritis	2	2 ds.	60	20	35	...	Did not return.
126	M. H.	Epith of face	8	3 mo.	50	20	185	...	.....
127	C. H.	Mel sarc	2	2 ds.	60	20	40	...	Did not return.
128	I. H.	Epithelioma	2	2 ds.	70	35	75	...	Did not return.
129	W. H.	Persist thymus...	3	2 wk.	60	25	75	...	No reaction. Gland smaller. Still treating.
130	M. H.	Carcinoma	11	5 mo.	60	30	310	...	No improvement.
131	W. H.	Psoriasis	5	1 mo.	50	25	120	...	Did not return.
132	W. I.	Sycosis	2	3 wk.	50	55	125	125	Slt erythema. No epilation.
133	L. J.	Med tumor	2	9 ds.	70	20	40	...	Did not return.
134	R. J.	Pruritis	1	.....	40	15	15	...	Did not return.
135	V. J.	Enlarged thymus.	1	.....	40	15	15	...	Did not return.
136	M. K.	Hyper thymus	2	.....	60	20	40	...	Still treating.

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137	L. K.	Pruritis	1	.....	40	30	30	...	Did not return.
138	M. K.	Lupus vulg	4	1 mo.	50	25	100	50	Very much improved.
139	K. A.	Pruritis	1	.....	60	10	.....	...	Did not return.
140	M. A.	Lupus	5	5 wk.	60	20	102	102	Rather severe reaction.
141	J. A.	Tuberculosis	4	4 ds.	60	20	140	...	Did not return.
142	J. A.	G. C. sarcoma...	6	17 ds.	70	50	220	170	Improved while under treatment.
143	H. C. B.	Sarcoma	3	4 ds.	75	25	75	...	Did not return.
144	M. C. B.	Epithelioma	10	5 wk.	70	20	215	190	Marked improvement.
145	M. B.	Epithelioma	6	5 wk.	50	20	195	...	To report in Sept. Improved.
146	B. B.	Derm ven	4	1 wk.	45	20	100	100	Improved, but not more than lesion (not treated).
147	J. B.	Herpes zoster	1	.....	60	25	25	...	Did not return.
148	M. C. B.	Sarc P-op	37	9 mo.	60	30	1100	842	Improved.
149	A. B.	Epithelioma	1	.....	?30	50	50	...	Healed.
150	R. B.	Verruca	1	.....	55	20	20	...	Did not return.
151	S. R. B.	Lymph leuk	16	1 mo.	60	50	727	R	Improved.
152	P. B.	Derm pap	1	.....	...	50	60	60	Did not return.
153	F. B.	Sycosis	5	8 mo.	50	40	180	180	Epilation complete. Result excellent.
154	M. B.	Pruritis	2	1 wk.	50	20	45	...	Did not return.
155	W. B.	Sarc testes	4	1 mo.	?	36	168	168	Improved.
156	C. B.	Pruritis	2	1 wk.	60	20	42	42	Improved.
157	A. B.	Malig parotid	8	5 wk.	70	25	215	...	Some improvement.
158	H. B.	Urticaria	7	1 mo.	50	30	185	120	Almost complete relief.
159	P. J. B.	Malig Lymphomata	5	3 mo.	50	30	174	...	Relief.
160	J. C. B.	Carc S max	8	6 wk.	60	50	310	310	Still redness, mass much reduced. Did not return.
161	F. B.	Kerat senil	5	5 wk.	65	40	180	45	Improved.
162	E. B.	Epithelioma	5	5 wk.	50	30	151	...	Improved.
163	W. C.	Acne rosacea	3	2 wk.	60	20	45	45	Improved.
164	M. E. C.	T. B. adenitis	7	3 wk.	70	15	140	...	Improved.
165	D. C.	Pruritis	2	2 wk.	40	15	30	...	No improvement.
166	A. C.	T. B. glands	3	3 ds.	60	20	75	...	Did not return.
167	Mrs. C.	Carcinoma	15	5 mo.	70	30	412	412	Slightly improved.
168	B. C.	Hodgkins Dis	6	1 mo.	50	15	155	100	Improved.

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169	M. A. D.	Epithelioma	1	.....	60	60	....	...	(Filter). Did not return.
170	M. D.	Pruritis	5	5 wk.	50	15	90	...	No improvement. Stop treatments.
171	S. D.	Mycos fung	6	1 mo.	50	20	122	70	Lesion healed rapidly.
172	M. F. D.	?T. B	7	2 wk.	50	20	150	65	Improved.
173	B. D.	Epithelioma	3	1 mo.	40	30	120	120	Much improved. Did not return.
174	Mrs. T. F. McG.	Carc	5	1 mo.	50	25	....	...	Did not return.
175	Mrs. T. McM.	R cheek	4	1 wk.	50	25	100	...	Improved.
176	Miss E. M.	Carc	27	7 mo.	60	25	....	...	Improved.
177	B. M.	Thymus	3	2 wk.	60	25	....	...	Improved.
178	Miss E. M.	T. B. Glands	9	3 mo.	50	25	....	...	Well.
179	P. A. N.	Carc Ear	22	8 mo.	50	25	....	R	Well.
180	Miss M. O.	Carc Face	2	12 ds.	65	25	50	...	Did not return.
181	B. O'T.	Thymus	1	.....	60	.?.	....	...	Did not return.
182	W. R. P.	Leukemia	2	3 ds.	60	.?.	....	...	Too sick for further treatment.
183	Miss E. P.	Carcinoma	20	14 mo.	60	.?.	....	...	Improved.
184	Mr. A. B. P.	Asthma	5	2 wk.	50	.?.	....	...	.....
185	Mrs. S. A. R.	Epithelioma	13	11 mo.	60	40	....	...	Well.
186	Mrs. F. R.	Carcinoma	5	1 mo.	50	25	....	...	Improved.
187	Mrs. A. S. S.	Carcinoma	15	6 mo.	50	25	....	...	Improved.
188	Miss H. S.	Goitre	21	1 yr.	50	25	....	...	Improved.
189	Mrs. J. F. S.	Moles	4	1 mo.	50	25	135	90	Improved.
190	E. G. S.	T. B. ulc cheek	3	1 mo.	45	50	....	...	Improved. Still treating.
191	Miss T.	Carcinoma	1	.....	60	.?.	....	...	Did not return.
192	Mrs. F. T.	Epith Nose	5	1 mo.	50	25	125	...	Improved.
193	Mrs. T. R. W.	Carcinoma	20	9 mo.	60	25	....	...	Improved.
194	Miss K. W.	T. B. Glands	11	2 mo.	50	25	....	...	Improved.
195	M. W.	Epith Nose	3	3 mo.	50	25	....	...	Improved.
196	Mrs. C. E. W.	Epithelioma	15	17 mo.	50	25	....	...	Improved.
197	R. H. W.	Epith Lip	2	1 wk.	50	25	....	...	Improved.

Some of the areas treated were too large to be covered at a single sitting. In these cases, the total amount of dosage received does not correspond to the amount received by a single area of skin surface. The cases are not numbered in the order in which they were treated.

Total number of cases treated 197

Total number of cases treated in which reddening of skin appeared 74

Total number of treatments given 1381

Average number of treatments given each case 7

Shortest duration of treatment where cure was obtained ..... 1 dose

Longest duration of treatment where cure was obtained ..... 1 year

APPLICANTS FOR ACTIVE MEMBERSHIP IN A. R. R. S.

Following is a list of the applicants for membership in the A. R. R. S. which will be published in the Journal twice before the annual meeting in accordance with the By-Laws.

With the approval of the other members of the Executive Committee I have determined to present the names of all applicants whether complete or incomplete indicating the deficiency in case of those who have not fully conformed to the By-Laws.

It is probable that where the application has been turned in within the specified time and no scientific paper presented or where a letter of recommendation was not presented within the time limit the Executive Committee will consider the applicant eligible if these are presented before the annual meeting.

The Following Have Complied in All Respects With the By-Laws:

Dr. M. J. Hubeny, 31 N. State St., Chicago, Ill. Recommended by Drs. A. Hartung and Hollis E. Potter.

Dr. Jacob Wm. Frank, 114 N. 17th St., Philadelphia, Pa. Recommended by Dr. A. J. Quimby and H. Clyde Snook.

Dr. Ernest Garde Edwards, La Junta, Colorado. Recommended by Drs. Russell H. Boggs and George C. Johnston.

Dr. Alfred Luger, Peter Bent Brigham Hospital, Boston, Mass. Recommended by Drs. Jas. T. Case and Walter J. Dodd.

Dr. J. S. Derr, 335 Candler Annex, Atlanta, Georgia. Recommended by Drs. J. W. Hunter, Jr., and Howard E. Ashbury.

Dr. Sam'l Beresford Childs, 342 Metropolitan Bldg., Denver, Col. Recommended by Drs. G. E. Stover and Hollis E. Potter.

Dr. Wm. B. Bowman, 818 Brockman Bldg., Los Angeles, California. Recommended by Drs. Albert Soiland and Edward H. Skinner.

Applicant for Corresponding Membership.

Dr. F. Howard Humphris, 8 W. Chappel St., Mayfair, London W., England. Recommended by Drs. George E. Pfahler and Edward C. Titus.

Applications for Active Membership Which are Deficient in Some Particular.

Dr. Harold B. Thompson, Seattle, Wash. Recommended by Drs. Hollis E. Potter and R. D. Carman. Complete, but application was not received complete until March 21, 1914.

Dr. L. Marsh Dolloway, 120 Nasby Bldg., Toledo, Ohio. Recommended by Dr. P. M. Hickey and H. W. Dachtler. Application received March 20, 1914. No scientific paper presented yet.

Dr. Max Kahn, 667 Columbia Ave., Baltimore, Md. Recommended by Dr. Albertus Cotton. Only one signature and no letters of recommendation.

Dr. Earl King, 75 Caroline St., Saratoga, N. Y. Recommended by Drs. Thurman A. Hull and Jas. P. Marsh. No letters of recommendation and no scientific paper.

Dr. Fred B. Hall, 618 Metropolitan Bldg., St. Louis, Mo. Recommended by Drs. E. H. Skinner and R. D. Carman. No scientific paper yet presented.

Dr. Wm. Albert Evans, 32 Adams Ave. W., Detroit, Mich. Recommended by Drs. Jas. T. Case and P. M. Hickey. Scientific article not yet submitted.

Dr. A. R. Taft, Charleston, S. C. Application not signed by members of the Society but a letter from Dr. Robt. W. Gibbes endorses.

Dr. E. S. Blaine, Cook County Hospital, Chicago, Ill. Recommended by Drs. Hollis E. Potter and Jas. T. Case. Lacks letter of endorsement from Dr. Potter.

Dr. W. T. S. Gregg, Calumet, Mich. Recommended by Drs. A. W. Crane and Geo. C. Chene. No letter of endorsement from local physician. Letters from the signers not received until March 23, 1914.

Dr. Robt. Emmett Austin. Recommended by H. Clyde Snook and Dr. Albert Soiland. No letters of endorsement and no scientific paper.

Dr. Jos. Friedman, 73 W. 116th St., N. Y. Recommended by Dr. Leopold Jaches. Application not signed by two members.

Dr. Anthony Bassler, 21 W. 74th St., N. Y. Recommended by Drs. E. W. Caldwell and G. W. Pfahler. Application received April 9, 1914. No letter of endorsement from local physician or surgeon.

Dr. Phillip Howard Cooke, 771 Main St., Worcester, Mass. Recommended by Drs. Percy Brown and H. W. Van Allen. Application dated 10/3/13, received 4/22/14. No letter of endorsement either from signers or local physician.

In every instance the applicant or his signer has been promptly notified of the deficiency where one existed.

Alfred L. Gray,
Chairman Exec. Com.

The American Journal of Roentgenology

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EDITORIAL

The education of the future Roentgenologist is of considerable importance. If he is to be regarded as helping more than a photographer and to be placed on a higher plane than the technician in the laboratory, he must devote considerable time and study and money to attain the knowledge and experience which will give his opinions value. Heretofore this training has been obtained principally by longer or shorter visits to Europe where greater or less information was obtained according to the familiarity of the student with the German language and his willingness to expend money for courses with the private tutors

In many of the medical colleges of this country, the course in Roentgenology is simply an advertisement for the one giving the lectures. This personal aggrandizement may not be intentional but in reality it is what the course often amounts to. The Roentgen specialist must have first of all a good knowledge of pathology. Unless there is this basic foundation of the principles of pathology, as applies to medicine and surgery, the interpreter of the different plates is most sadly handicapped, in fact, without this he never can rise to anything but mediocre attainments. Pathology is the most important knowledge for a Roentgenologist.

In one medical college the course of instruction presented is as follows: At the close of the lectures on embryology in the first year, the professor of Roentgenology gives a series of lectures showing the application of Roentgenology and taking up the development of the skeleton of the embryo and of the growing child from the Roentgen standpoint.

At the close of the lectures on anatomy in the second year, are given a number of lectures on normal Roentgen anatomy demonstrating to the student the appearance of the normal bones and joints which he has studied as depicted by the Roentgen plate. The student is required to study these normal plates and to pass an examination on their interpretation.

In the third year after a student has finished his studies in surgical pathology, he is shown the Roentgen pathology of bones and joints. In the fourth year in connection with his clinics, he is instructed in the interpretation of plates of medical pathology. While it is perhaps hardly desirable to disassociate surgical and medical pathology, still from a practical standpoint, the teaching of surgical Roentgen-pathology in the third year and medical Roentgen-pathology in the fourth year has practical advantages. While such a course as this does not give the student any more than a general idea of the subject, he receives his diploma with more of the knowledge than would be gained by simply listening to a few lectures in one semester. However, if he takes up the specialty of Roentgenology, what he has so far learned is to be regarded as simply a general smattering. We are glad to notice that in various parts of the country, courses are being offered for the education of the Roentgen diagnostician. While some of the post-graduate schools have perfunctorily added on certain lectures to their post-graduate curriculum, these have not been usually of much value to students. The best way at present is to enter as a voluntary assistant some large laboratory where he will be given the daily opportunity of the interpretation of plates, checking up if possible, with the other laboratory findings and operative procedure will help very much. If the people throughout our country are to have the benefit of Roentgen diagnosis, there must be a number of educated Roentgenologists who can lend their help. It will take much time and thought to properly develop educational facilities and the future Roentgen course will only gradually be evolved.

Announcement of Annual Meeting

THE American Roentgen Ray Society will meet in Cleveland at the *Hotel Hollenden, September 9th to 12th inclusive, 1914.*

The program promises to be of unusual interest and value, and includes a paper by Dessauer of Frankfort, on the subject of artificial production of gamma rays; Coolidge, the inventor of the Coolidge tube, Schearer and Duanne will also read papers. The subject of deep therapy and the production of the hard rays will be fully presented and discussed. The rest of the program will be taken by a large number of papers on general subjects. The medical profession is cordially invited to attend these meetings.

Very truly,

W. F. MANGES,
Secretary.