

Summary of Table.

							Inoculated.		Non-inoculated.
Strength	...	...	...	...	...	...	15,624	...	43,520
Incidence of attack, per 1,000	...	...	...	...	...	...	14.1	...	47.3
Incidence of pulmonary complications, per 1,000	...	...	...	...	...	...	1.6	...	13.3
Deaths, per 1,000	...	...	...	...	...	...	0.12	...	2.25

the *B. influenzae* moiety of the vaccine, it being urged that a considerably larger dose of this might be given with safety and with the prospect of an enhanced degree of immunity. In view of this, and also of the fact that, as the bacteriological experience of the epidemic extended, the etiological rôle of Pfeiffer's bacillus came more and more into prominence, I consulted my colleagues of the original conference afresh upon this point and found them all in agreement with an increased dose of Pfeiffer's bacillus, which I proposed should be raised from 60 millions to 400 millions in 1 c.cm., it being understood that the strains employed should not have been so cultivated or so recently derived from cases as to be unduly toxic in their action.

The formula of the vaccine as thus revised, and as now employed in the army, is therefore:

			Millions.
<i>B. influenzae</i>	...	...	400 in 1 c.cm.
Streptococci	...	...	80 "
Pneumococci	...	...	200 "

From the first it was desired that every attempt should be made to secure clear statistical evidence of the results of the inoculations with the vaccine, and the necessary instructions to this effect were circulated by the War Office; returns, in accordance with a simple *pro forma* being called for at regular intervals. In theory, such clear evidence should have been easy to collect through the workings of official machinery; in practice, it has been very difficult. Only those familiar with the strain thrown on the medical personnel by the addition of a severe and widespread epidemic to the already sufficiently arduous labours of those days of urgent and wholesale demobilization can appreciate the difficulties of collecting and recording, in accurate detail, the information required for the returns. In spite of these difficulties, which unfortunately vitiated some of the returns, a considerable number of inoculations were carried out and the records were received and analysed at the War Office.

Although it is very far from my intention to make any claim that the figures here presented are conclusive and free from all or even, in some cases, from possibly large fallacies, they serve, I think, to show at least the general trend of the inoculation results, and they have encouraged the hope that, with the larger dose of Pfeiffer's organism now employed, the vaccine, should it be needed, may prove a powerful reinforcement to other measures of protection.

A few words are called for in explanation of the table. The individual returns are shown under the name of the unit or the principal station in or near which the soldiers in question were located. The period covered by each return is shown in a separate column. The "strength" is the "average strength" of the unit or station; no other method was possible in view of the fluctuations of the population. The "inoculated" include those inoculated before the period in question, as well as those done during it, while the "uninoculated" are arrived at by deducting the inoculated from the average strength. The number of cases, complications, and deaths are, of course, not averages but actual figures derived from the hospital records. The recording of pulmonary complications is probably lacking in uniformity, since different medical officers may have taken different views as to the degree of bronchial or pulmonary involvement which should be taken as a complication.

The returns, all of which lie within the period between November, 1918, and April, 1919, comprise all those relating to this period which conformed to the following requirements:

1. That the vaccine used was that prepared at the Royal Army Medical College, according to the original formula.
2. That influenza should have been present in the unit during the period under review. In many stations where inoculation had been largely carried out there was a rapid cessation of the epidemic. Such returns would have swelled the total of the inoculations without throwing any light on their protective effects.

3. That only such returns are included as showed that at least one-tenth of the average strength had been inoculated, whether with one dose or two.

Periodic returns have continued to be received since the period dealt with in the table, but these have been either negative altogether as regards incidence of the disease, or show so few cases of influenza in either group as to be valueless from a statistical standpoint.

Information was asked for as to the interval occurring between inoculation and a subsequent attack of influenza, but the figures in response to this are too few to be worth analysing; it need only be said that they furnish little or no evidence of any increased susceptibility in the days immediately following inoculation, and that they throw no light of any value on the duration of the immunity conferred by the inoculations. The figures bearing on the latter point would, in any case, have been exposed to the fallacy that the epidemic was rapidly declining throughout the forces, and that the inoculated population was drifting, with increasing rapidity, out of our control into civil life.

No bad effects were reported from the inoculations, and the reactions, in the overwhelming majority, were trivial or non-existent.

It will be noted from the table that nearly one-half of the inoculated had received only the first dose of the vaccine—that is, one-third of the amount which we considered essential to effective protection. It is reasonable to assume that, had all received the full dosage, the protective results would have been still more evident. No statistical evidence bearing upon this point is, however, available.

The table had best be left to speak for itself, but it will, I think, be admitted that in general the results are encouraging, and that they tend to confirm and even strengthen our original anticipations, which were, briefly, that at least a moderate degree of protection against infection might be expected, while more decidedly beneficial effects might be hoped for in a diminution of both the frequency and the gravity of the pulmonary complications.

OBSERVATIONS ON THE X-RAY TREATMENT OF NEOPLASMS.

By G. E. VILVANDRÉ, M.R.C.S., L.R.C.P.,

CHIEF ASSISTANT X-RAY DEPARTMENT, LATE HOUSE PHYSICIAN
SKIN AND LIGHT DEPARTMENT, LONDON HOSPITAL.

WHEN we are able in all cases to diagnose malignant disease early the use of x-ray therapy will be limited to those cases only in which mechanical and physiological considerations prevent operation. Until this be attained we have to deal with a large number of tumours which, because of their size and position, forbid the use of the knife.

This paper is not a criticism; it gives the result of observations of facts and deductions, I believe logical, which have been forced upon me during the past three years. Thanks to the kindness of my former chief, Dr. J. H. Sequeira, many cases came partly under my care and observation.

My object in investigating them was not only to obtain successes, but also to inquire why we succeeded in some and failed in others, for upon this knowledge depends future success and the alleviation of much suffering.

R. G. was sent by Dr. Lack as being beyond operative treatment with sarcoma of the tonsil. The right side presented a large growing tumour, obviously quite vascular. Before November 22nd, 1915, attempts at removal when small had been made, but the tumour recurred, and on that date she was, under Dr. Sequeira's direction, submitted to x-ray treatment, the dose being a weekly one of Sab. B₄ pr 1½ mm. to outside of tumour and Sab. B₃ pr. 1 mm. of aluminium to the nasopharynx. In January, 1916, she was very much better, and the glands were going down. She had more x rays on February 7th, 1916. On February 28th Dr. Lack saw her and reported, "Much better—

no glands." The same doses were given until May 29th, 1916, and then once monthly to September 18th, 1916.

On September 28th, 1916, Dr. Lack wrote: "Firm fibrous thickening above right tonsil, neck smaller." In January, 1917, more treatment (three doses). On February 23rd, 1917, "Much thickening" was noted, and afterwards treatment was followed by gradual improvement; except for a small radiotherapeutic burn she had continuously done well.

To-day she is still well, and though the growth may not be completely eliminated, she looks fit, and is living an efficient life; the neoplasm has remained stationary since March, 1917; the pain—once a prominent symptom—has gone, and a hopeless prognosis in 1915 has been converted into a possible cure and three years of efficient and comfortable life.

The following case is more striking still:

B. C. was admitted in April, 1911, with a tonsillar affection of some duration for which he attended several hospitals. The right tonsil was swollen and red and protruded forward into the mouth; its lower limit could not be seen. He was very thin, pale, and had lost much weight. A diagnosis of sarcoma was made. A week after he was much worse, the swelling protruding more into the mouth, and his condition was looked upon as hopeless; Dr. Sequeira did not think the boy should attend the hospital again. In May the glands were irradiated through filters and improvement occurred, but on May 23rd there was a setback in his general condition. Treatment by radiation was persevered with, and July saw improvement and the "swelling much less."

In November, 1911, "the palate moves easily and the growth has almost gone," but glands were still palpable on the left side, and more treatment was given twice a month until May 4th, 1912, when he was pronounced quite well. A month later the same note was made. In September, 1912, he was still well and passed a medical examination for the Railway Clearing House. When seen again in January, 1913, and May of the same year, he was still well. He joined the army in 1914, and was still well in June, 1916.

This was an undoubted success.

Early in 1914 I saw a case which had been diagnosed by a surgeon of repute as sarcoma of the chest wall. When treated with x rays the whole disappeared. The surgeon, on seeing the case again, suggested that the diagnosis could not have been accurate; but he himself had made the diagnosis. The tumour had been there and was gone, and x rays alone had been used. The patient, a girl, died some two years after of pneumonia.

E. O., aged 17, had a swelling of the right upper maxilla, which was hard and definitely enlarged to the touch and sight; the patient was sent for treatment with the diagnosis of sarcoma. The tumour had been present for six months; the Wassermann reaction was negative. I thought the prognosis bad. Heavy doses of x rays were given during September every four days, and when seen on November 21st, 1918, the swelling was much smaller. The patient's general health was good and more treatment was carried out. In February, 1919, the condition was quite good and the swelling negligible. When I saw her on October 26th, 1919, she was quite fit, and there was no indication for treatment.

I might quote other cases, but only wish to establish a fact which is known to some—namely, that some sarcomata may be inhibited by x -ray treatment.

To quote cases of inoperable carcinoma of breast in which benefit, such as prolongation of life, complete disappearance of pain, retrogression of the growth, improvement in general health, are well-marked features would weary the reader. Some of us know by experience of many cases so benefited, and the number runs into hundreds. I may, however, be excused for mentioning the case of a school teacher who had carcinoma mammae; x -ray treatment was delayed and, as often happens, recurrence followed. The combination of x -ray treatment and radium has, however, enabled her to carry on for nine years since the appearance of the first recurrence. Each new growth is tracked by the application of a radium plate; she illustrates vividly the spread of carcinoma by lymphatic vessels in so far that the radium reaction has left telangiectases wherever the plate has been applied. Although taken late for treatment, this patient has had nine years of life and the capability to earn her daily bread. I saw her last a few months ago.

Of the value of radiation of the site of glands after removal there can be no doubt, and I would plead for the routine radiation of scars after removal of squamous-cell carcinoma of the lip and other such tumours, just as surgeons send their cases of breast cancer after operation.

Looking back upon cases of new growths treated by x rays, I have seen the greatest benefit or inhibition in sarcomatous neoplasms, and in my experience in the slow-growing varieties.

Leaving rodent ulcers on one side—in which radium treatment shows at its best, and of which many cures have been published by others, such as Dr. Sequeira as far back as 1908 at the International Congress of Surgery, Brussels—it may be said of carcinomas that the results of radiation are not so striking. A patient with carcinoma is more likely to have secondary glandular involvement than one diagnosed early as suffering from fibro-sarcoma; but, putting this probability on one side, the results are not so good in squamous-cell carcinoma, for instance.

I was inclined to think that the vascularity of the growth was a determining factor, looking upon a fibro-sarcoma, for instance, as one less vascular than the fungating tumour received from the surgical side of a hospital for x -ray treatment as a last resort; but experience with enlarged spleens tends to modify that hypothesis, for it is difficult to imagine a more vascular organ, and yet the diminution under x rays of an enormous spleen, such as is seen in cases of leukaemia, is most striking.

Breaking down malignant glands such as follow an "epithelioma" of the lip, or squamous-cell carcinoma springing upon an ulcerated lupus lesion, do not do well under x -ray treatment.

A case in point was that of B. N., who had had lupus vulgaris of the face for years. Squamous-cell carcinoma made its appearance. Thorough treatment was carried out by diathermy and not without success; the lower two-thirds of the lesion did well and healed, but there remained a focus in the lax tissues of the lower eyelid which, when again attacked by diathermy and x rays, grew apace.

Neoplasms of the lung react to hard rays, and though I have not seen one disappear, diminution of pain, cyanosis, and cough, and even retrogression of the neoplasm, do follow radiation; but heavy filtered doses are necessary.

Bulk is no hindrance; it is the nature of the growth that counts. As I mentioned before, the vascularity of the growth is not the important factor, but the more fibrous tissue present in the stroma, as a rule, the slower the growth and the better the result of radiation. Natural means of checking invasion are helped readily by the physical. X rays tend to cause or help the formation of fibrous tissue, but only x rays of a certain type.

Much good histological work has been done on the effect of radiation on cells, as anyone who reads the excellent work of Sidney Russ and Colwell on radium, x rays, and the living cell can see. But we are only on the threshold of knowledge of these phenomena. The removal at fortnightly or monthly intervals of irradiated glands whenever possible, their section-cutting and examination by a competent pathologist would prove of value. The radiotherapeutical department of a hospital should work hand in hand with the pathological.

In many of these cases submitted to x radiation it is useful to ascertain whether the Wassermann reaction is present, especially where the position of the growth or other condition forbid the removal of specimens for histological examination.

The x rays can be divided into at least two great classes, according to their effect—namely, those that give rise to stimulation of growth, and those that cause inhibition and, further, necrosis. The first effect seems certainly to be associated with the treatment of superficial lesions, such as lupus vulgaris and its frequently accompanying ulceration. In this connexion two points are of importance: first, the rather frequent occurrence of "epithelioma" on lupus, especially in cases that have received frequent x -ray treatment by small doses of unfiltered rays. It is a point among others showing the necessity of the skilled control of a therapist over the too-often haphazard methods of x -ray treatment. X -ray burns are a sad evidence of injudicious dosing, but they at least call attention to over-treatment. The formation of epithelioma on lupus works silently, only revealing itself, as a rule, too late for cure. Needless to say, the constant granulation that goes on, the repeated attempt at healing, the frequent division of cells, are factors in the production of cancer in these cases, but there remains a large number where the presence of squamous cell carcinoma coincides with repeated application of rays in small doses. These are often the legacy of earlier days in radiotherapy.

X Rays and Arsenic.

I was inclined to look upon this appearance of squamous-cell carcinoma on lupus and also in *x*-ray workers from repeated small exposures of $\frac{1}{2}$ to $\frac{3}{4}$ Sab. B, as being due to an irritative effect of the "soft" rays, the formation of the skin cancer being regarded as similar to that of lip cancer in clay pipe smokers, epithelioma of the tongue following dental irritation, and so on. The parallel between the effects of *x* rays and arsenic is not without significance. Both may cause erythema, both give rise to pigmentation and hyperkeratosis. Arsenic certainly causes a neuritis, and *x* rays have been described as doing the same. After the prolonged effects of each we may observe carcinoma. To have looked upon this common action as an over-stimulation was, I think, natural. But, in the words of Dixon:

Arsenic under certain conditions gives rise to a peripheral neuritis which closely resembles that of alcohol. The action is essentially one on the interstitial tissues, the connective tissue sheaths of the nerve being affected in the same way as connective tissue elsewhere in the body. It becomes hyperaemic, shows multiplication of new tissue elements and migration of leucocytes. These changes lead to pressure on nerve fibres, and so to later degeneration.

The end results of prolonged exposures to "soft" *x* rays are the same on the skin as those of the prolonged use of arsenic. Hyperkeratosis, usually affecting the soles and palms, is peculiar to arsenic among drugs. Hyperidrosis is then often prevalent in these places, appearing as small elevations like millet seeds or small corns. Epitheliomas may develop on these small corns. The hands of the radiographic assistant of early days may be compared with this.

Is it, then, too much to deduce that in the latter case nerve fibres also become degenerated, and that some forms of carcinoma are due to lack of nerve control of the cells? I have heard this theory before, and only suggest that the similarity of action of *x* rays and arsenic is another fact in favour of the theory.

Mrs. M. was at one time a skin patient. She had also exophthalmos, some cyanosis, dyspnoea, clubbing of fingers, dullness in the sternal region, and other signs, and was sent to the physician for thoracic disease; a diagnosis of mediastinal neoplasm was made. The patient ultimately died of broncho-pneumonia, and *post mortem* a growth around the arch of the aorta, of the size of a small apple, was found.

This patient had some *x*-ray treatment, and though certainly the case was advanced, her death was not without a lesson, which I now wish to point out with due humility. Such a tumour should be radiographed, and I will even suggest localized. To hand over such a case as "tumour of the thorax" to a lay assistant for radiation is a mistake. His knowledge of anatomy is negligible, of disease still less; and unless careful focussing of penetrating rays in heavy and repeated doses are carefully and accurately applied to the growth, it may be from several angles by a cross-fire method, the chances of hitting the tumour are *nil*. It is therefore essential in such cases to transfer upon the thoracic wall with indelible pencil the findings of clinical and radiographic and localization methods. Accuracy of focus is, I am certain, a primary essential factor in *x*-ray treatment. The chances of missing with a pencil of rays a tumour the size of a small apple in such a large cavity as the thorax are, of course, very great. Careful localization and markings are of primary importance.

It is easily realized that neoplasms, be they sarcomas or carcinomas, especially if large, will require prolonged treatment. The care of the skin is therefore paramount, for unless great precautions be taken erythema and, too often, burns will follow, preventing further treatment, and consequently destroying all chances of alleviation or cure. A shield on the patient will protect all organs except those in the direct paths of the rays passing through an aperture in the shield. Only the diseased tissues will therefore be irradiated. It may be argued with reason that many foci of infection are possibly present, and that wide radiations are beneficial. If such be the case the prognosis is bad whatever treatment be given. The presence or absence of secondary deposits will sometimes be revealed by radiographic examination.

That the localization of the growth is essential will be easily understood when it is remembered that the power of the rays is inversely proportional to the distance of the

object from the anticathode. For success, therefore, it is essential that the depth of the object be known, for on that, I think, the dosage should also be based. Far less radiation will reach an object 8 in. than one 2 in. deep.

Time will show that the doses we have given are inadequate. Heavier doses of "harder" rays through thicker filters are those that will cause inhibition of neoplasms. We have done well in some cases, failed in others. Where two years ago I gave 4 Sab. B through 2 mm., I now give 8 or 12 B's through thicker filters and the results are better.

My thanks for opportunity and advice are due to Dr. Sequeira; for practical help am I also indebted to Mr. Blackall of the London Hospital. The mistakes are mine.

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CHRONIC INFECTION OF THE FAUCIAL AND POST-NASAL LYMPHOID TISSUE IN CHILDREN.

BY

PERCIVAL W. LEATHART, M.B., B.Ch. CANTAB.,

ASSISTANT SURGEON, LIVERPOOL EYE AND EAR INFIRMARY.

A CHILD with enlarged tonsils and adenoids is not ill because of the increased size, but because of a chronic infection of its faucial and post-nasal lymphoid tissue, which serves not only as a nidus for the manufacture of toxins, but also as a port of entry for many other systemic diseases. This condition of chronic infection is extremely common, and diagnosis is easy if the three cardinal physical signs—enlarged tonsils, rhinitis, and enlarged cervical glands—are kept in mind. Additional physical signs are often to be noticed, such as running ears, bronchitis, mastoiditis, etc., but are more correctly described as complications, and are found as a rule only in neglected cases. That the disease is highly infectious is shown by the following facts:

1. That it is far more frequent among school children than among children who do not go to school.

2. That when one child in a family is attacked the disease subsequently spreads to his brothers and sisters who were previously healthy.

3. Micro-organisms can always be grown from the nasal and post-nasal secretions, which are normally sterile.

For these reasons the disease may be considered as infectious in exactly the same way as measles and scarlet fever are infectious.

Unfortunately in this disease there does not appear to be as great a tendency to spontaneous cure as in some of the other specific infections of childhood; it is a very much more chronic condition, and in consequence of this once a child is attacked he may, and often does, continue in a more or less normal manner for years; but on examination will be found to present the three cardinal signs of the disease, and micro-organisms will be detected in the nasal and post-nasal secretion.

Such a child is, in fact, a "carrier," and is for that reason a source of danger to all healthy children with whom he may come into contact. Because of the chronicity of the disease it follows that nearly all untreated cases are carriers for a longer or shorter period, and this would appear to be a good reason for its frequency.

A sufficient number of bacteriological examinations of secretions from the nasal and post-nasal spaces have not hitherto been made to enable us to be dogmatic with regard to the nature of the specific causal organism. But in a very large proportion of such examinations some form of pneumococcus has been the predominant organism, and in some cases it has been the only one grown. This, coupled with the fact that some form of pneumonia is a frequent complication, renders it possible that the pneumococcus is to blame. But whatever the organism may prove to be it is one which attacks the faucial and post-nasal lymphoid tissue, producing a form of inflammation which is not acute, so that pain is seldom complained of; it is typically a chronic inflammation in the course of