depression (the jaundiced outlook), but in the cases here described the temperament is placid, pleasant, and cheerful, in spite of the high blood content of bilirubin.

I am greatly obliged to Dr. T. H. Oliver of Manchester for his kindly help and assistance, and Drs. W. M. Roberts, G. F. Langford, and G. S. Smith for the laboratory work.

REFERENCE.
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OBSERVATIONS ON THE COMBINED ACTION OF COLLOIDAL LEAD AND RADIATION ON TUMOURS.*

BY

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THERE is evidence that the inoculation of colloidal lead into the circulation gives rise to thrombosis of the blood vessels of tumours.¹ Radiation also causes interference with the blood supply and thrombosis apart from its direct destructive

Similarly, three-quarters of the lethal dose of radiation—that is, fifteen minutes—never caused the tumour to disappear, though a temporary slowing of the rate of growth occurs, as seen by comparing Charts 1 and 3.

Combining these two treatments two sets of experiments were carried out. In one set the lead inoculation was given first and the radiation after varying intervals of time. In the other set the radiation preceded the inoculation of lead. When the radiation was given first mice were grafted with small pieces of T/63 into both flanks. When one of these had grown to 5 by 5 or 6 by 4 mm. superficial area it was radiated for fifteen minutes. After intervals of 1, 2, 3, 4, and 5 days 0.06 c.cm. of lead per gram of weight (mouse) was inoculated into the tail vein. The tumour on the other side served as a control.

In the experiments when lead colloid was given first mice were grafted as before. The lead was inoculated when one of the tumours measured 5 by 5 mm. or less, and the radium applied within a few hours, or later, when the tumour had grown to 5 by 5 mm. Long intervals between lead and radiation were difficult to arrange, because it was not possible to know precisely how long a small nodule

CHART 1.—Showing the normal rate of growth of T/63, measurements being made three times a week. (As also in all subsequent charts.)

CHART 2.—Showing the rate of growth in animals which have had 0.06 c.cm. of lead colloid per gram of mouse inoculated into the tail vein at the time of the first measurement.

CHART 3.—Showing the rate of growth of tumours exposed to fifteen minutes' radiation at the time of the first measurement.

action on tumour cells.^{2,3} Experiments have therefore been carried out to see whether, by combining these two therapeutic measures, tumours can be made to disappear by such doses that the toxic effects of lead on the patient would be avoided, and likewise the destructive action of radiation on normal tissues and its other harmful effects.

EXPERIMENTAL DETAILS.

The mouse tumour T/63 was used. This tumour having once grown to a measurable size has never been observed to regress. Its disappearance is, therefore, certain evidence that it is the experimental conditions which are adversely affecting the tumour, and not concomitant immunity. The colloidal lead, containing 0.5 per cent. of lead, was supplied by British Colloids, Ltd. Radiation was obtained from a radium applicator of 110 mg. RaBr, 4H₂O, having an area of 2 by 2 cm. and screened with 0.15 mm. of silver. Preliminary observations showed that 0.08 c.cm. of lead colloid per gram of weight (mouse) was approximately the lethal dose. Previous work had shown that twenty minutes *in vivo* exposure to a T/63 tumour measuring 5 by 5 mm. was just sufficient to cause it to disappear. It was decided to work with three-quarters of these doses in each case. For lead an inoculation of 0.06 for each gram of mouse weight never caused death. It did, however, affect the general health of the animal, as shown by a decrease in weight beginning on the third or fourth day, with recovery on about the tenth day; the decrease amounted to about 10 per cent. There was also a slight slowing of the rate of growth of the tumour, as seen by comparing Charts 1 and 2.

* A paper read at the British Institute of Radiology on January 19th.

would take to grow to 5 by 5 mm. after lead treatment. The results of all these experiments are given in the following table. Each + or - represents a treated tumour.

Table of Results.

Radium Exposure before Lead Inoculation.

Days' Interval.	Tumours Grew.	Tumours Disappeared.
5	++	
4	+++++	
3	+++++	
2	++++++	
1	++	

Lead Inoculation before Radium Exposure.

Days' Interval.	Tumours Grew.	Tumours Disappeared.
0	+++	
1	+++	
2	+++++	
3	++++++	-----
4	+++++	---
5	+	
7	+++	
12	+	

The table shows that when the radiation precedes the lead treatment up to an interval of 5 days, no disappear-

ances of tumours occurred. When the lead inoculation was first given with intervals of 0, 1, 2, 5, 7, and 12 days, there were also no disappearances; but with intervals of 3 and 4 days, 8 complete disappearances of the treated tumours occurred out of 22.

CHART 4.—x=Disappearance of tumour.

The growth of these 22 tumours is shown in Charts 4 and 5.

COMMENT.

The above results show that the combination of these two therapeutic measures will cause a tumour to disappear, using doses which, by themselves, do not produce this effect, but only result in temporary retardation of growth.

It has been suggested that this effect may be due to both treatments acting upon the blood vessels of the tumour and interfering with its supply of blood. In the case of radia-

tion this action has been shown first to occur about 4 days after exposure.² Since the best effects of the combined action are obtained with intervals of 3 and 4 days, it follows that lead must begin to act on the blood supply of the tumour about 7 to 8 days after inoculation, provided, of course, that lead acts in this manner. It has also been suggested that radiation has greater action after lead treatment on account of the secondary radiation arising from the lead deposited in the tumour. If this is so, it can hardly be due to any increase in density of the tumour, as the amount of lead present is too small to alter this

CHART 5.—x=Disappearance of tumour.

appreciably. It might, however, be due to the characteristic secondary radiation from the lead, as this is a new factor with qualitative difference. The results support the view that this combination of treatment should be given a trial in the case of patients suffering from cancer. The radium used was on loan from the Medical Research Council.

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Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

A METHOD OF DEALING WITH A SWALLOWED OBJECT.

(With Special Plate.)

THE following case is of interest inasmuch as it indicates a practical method of dealing with opaque objects that have been accidentally swallowed.

The patient, a schoolboy aged 12, was brought to me with the history of having swallowed the key of his tuckbox. He had placed it in his mouth while unpacking the contents of the box. A school pal gave him a friendly slap on the back, and down went the key, ring, label, and all. The x-ray examination clearly displayed them in the stomach (Fig. 1).

It occurred to me that I might here make use of the method I devised for gastric investigation after an opaque meal—namely, radioscopy. I found that I had full control over the foreign body by manipulation through the abdominal wall. I proceeded to manoeuvre the key through the pylorus. As the handle of the key was directed towards the pylorus a complete turning round was necessary. With careful manipulation the wards of the key—that is to say, the lock end—were persuaded to engage in the pylorus. However, the ring and metal disc, both about the size of a two-shilling piece, could not be induced to pass.

The lad was then told to go out and eat as big a lunch as he could without any fluids. To him this was a pleasing suggestion. The manoeuvre proved successful, for at the second examination, some three hours later, the key could be seen in the small intestine. A dose of castor oil was ordered, and the key was safely delivered the next day *per vias naturales* (Fig. 2).

It is, of course, quite possible that it would have passed out of the stomach without the assistance here described, but the anxiety of the parents was certainly curtailed, and it is quite conceivable that, in cases where the swallowed object is of an awkward shape or of large size, the possibility of being able to get the most suitable presentation to engage the pylorus is of some value.

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TOTAL HEPATOPTOSIS.

I BELIEVE the condition of total hepatoptosis is not a common one, and this is my reason for recording such a case in an old woman, aged 75, whom I recently attended in a terminal illness for congestion of the lungs.

I had this patient under observation for some years, and from her figure and fullness of the abdomen I suspected she might have an ovarian tumour. From time to time I attended her for slight malaise and noted that she had some oedema of both feet and legs, which, together with the fullness of the abdomen in an otherwise spare woman, rather suggested an abdominal tumour, but she persistently declined a general examination.

In December, 1927, I was summoned to see her for a chill and a chest condition; a general examination disclosed a tumour which appeared to occupy the whole of the abdominal cavity, the more so as the patient was in the sitting posture propped up in bed. The tumour was smooth and even in outline and extended upwards to the costal margin; laterally it occupied the right flank, and reached the mid-Poupart line on the left. In the downward direction the tumour ended about two inches below the umbilicus, its most dependent part being an edge which conformed to the line of the liver, with the notch between the lobes. On palpating the mass I could get my fingers well underneath it, and quite easily and clearly delineate the liver edge across the hypogastrium through the thin flaccid abdominal wall. The liver could be raised upwards to bring the anterior margin in close apposition to the skin, demonstrating thus its sharp edge and making the inferior surface look forwards. On percussion over the mass the note was dull. The liver was mobile, allowing considerable range of movement, and there was no tenderness or pain on examination. The right hypocondrium had a resonant note, in place of the usual liver dullness.

Besides the wandering liver, examination of this patient showed curvature of the spine, a condition which is occasionally associated with hepatoptosis, also an enlarged thyroid gland. The woman had borne six children, and the abdominal wall was lax and pendulous—another associated condition.

Apparently the patient was unaware of this unusual abdominal content; the only physical sign arising therefrom appeared to be the oedema of the feet and legs, possibly due to interference with the inferior vena cava. The liver was in a position of anteversion with slight rotation to the right.

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