

specimens which had not been radiated were similarly prepared. Using a square graticule in the eyepiece of the microscope, drawings were made, on squared paper, of the red cells seen. In this way a picture of the amount of blood in the capillaries was obtained. No differences between experiment and control were found in the twelve-hour and twenty-four-hour specimens. The results obtained with intervals of two, three, and four days are illustrated in the accompanying figure, which shows the drawings obtained as described. In choosing a piece of tumour to draw, an area of the section was always selected where blood vessels were most numerous and the tumour neither degenerated nor necrotic.

It will be seen that after two days (column 1), and especially after three and four days (columns 2 and 3), the capillaries in the radiated specimens contain very little blood as compared with the control specimens (columns 4 and 5). The areas of fine scattered dots represent haemorrhages, and it is seen that these are more numerous in the experimental animals. The differences which have been observed may therefore be well accounted for by the fact that tumour cells allowed to remain in the body after radiation suffer from an interference with their blood supply, as well as from the direct effects on them of the radiation.

#### Theoretical Considerations.

Starting from this fact, there arises the question whether the difference in radio-sensibility between normal tissues and tumours is related to effects on blood vessels. It is known that tumours, and especially malignant tumours, have an inefficient vascular supply. Any interference with this will thus operate against them more than against

normal tissues. Further, in many malignant tumours the supply of blood is so poor that necrosis is of common occurrence, apart from radiation. Such tumours are especially sensitive to radiation, after which widespread necrosis may occur. Rapidly growing tumours, which presumably make a large call on the blood supply, and tend to outgrow it, are likewise said to be especially sensitive to radiation. Non-malignant tumours seem to fall into line as their vascular supply is less differentiated than normal tissues, but more than malignant tumours, whilst the sensibility is likewise intermediate. How far this hypothesis will account for the facts of radiation remains to be seen; it is now put forward as a working hypothesis which may prove useful in therapeutics.

#### Conclusions.

1. Tumours left for four to five days in the animal after radiation, and then removed and grafted into other animals, succumb more easily than when removed immediately after exposure.
2. This effect is associated with an interference with the blood supply, which occurs four to five days after the exposure.
3. These results suggest the hypothesis that the varying sensibility to radiation of tumours, and the difference in sensibility between normal tissues and tumours, are associated with the variations in blood supply, on which the radiation has a special action apart from its direct action on cells.

## ASTHMA WITH MAXILLARY SINUSITIS AND A HEALTHY SUPERNUMERARY PARANASAL SINUS.

BY

W. S. THACKER NEVILLE, M.D., F.R.C.S.E.,  
DARLINGTON.

THE patient whose case is recorded below is a medical student, aged 20, whose studies were interfered with by recurrent attacks of asthma. He came to see me on August 7th, 1926, and gave the following history.

He said that he had had bronchitis in October of the previous year, and that after three days in bed asthma developed, the attacks continuing during the succeeding three weeks. He then studied in London for the primary Fellowship examination, and while there was free from attacks, but on returning home, where he remained until the end of January, 1926, he suffered from slight attacks of asthma occasionally, with shortness of breath on exertion. On resuming work at a university in the North of England he had severe attacks for three nights, so he returned home. He had shortness of breath each morning, and asthmatic attacks at intervals of five or six weeks, each attack lasting for a week or two. For three weeks before coming to me he had never once been free from asthma. He had used adrenaline frequently, and had had four injections of peptone during the week in which I saw him.

I found his nose normal, except for a few threads of mucus extending from the septum to the lateral walls; some mucus was present on the floor of the nasal orifice. The tonsils and adenoids had been removed in childhood, but a portion of the left tonsil was still present. The larynx and vocal cords were red, and the trachea, which was easily exposed, was injected. On transillumination both maxillary sinuses were dark. By puncture and washing a mass of mucoid material was expelled from the right sinus; the left sinus showed only a few strings of mucus. Three days later the patient returned, and said that he felt better than for many weeks. Puncture was again performed, and on this occasion a mass of mucoid material was expelled from both sinuses. On the next day puncture of the right sinus revealed the same condition, but the left sinus washing was clear.

On August 14th a Caldwell-Luc operation was performed on both sides, the anaesthetic employed being morphine and scopolamine, with local injections of 1/2 per cent. solution of novocain, and the application of cocaine paste in the nose. On the right side a small normal sinus was exposed, and a counter-opening was made posteriorly below the inferior turbinate; the wound was then sutured. The left sinus was found to be similar to the right, but perforating a thin partition brought to light a sinus lined with polypoid mucous membrane, on the floor of which a strand

of pus was lying. The sinus was scraped with a curette round which was wound gauze soaked in 10 per cent. zinc chloride solution, and the partition, which had completely divided the antero-medial from the posterior lateral sinus, was removed. The sutures on the right side were then taken out and a similar partition was discovered, which, on removal, opened up a sinus presenting the same pathological appearance as the left.

By September 16th the patient had been free from asthma for about a month; on recurrence then, I washed out the sinuses and retained secretion was found. I removed the anterior ends of the inferior turbinates, and enlarged the intranasal opening to enable the patient to use lavage himself. On October 21st the patient, who was regularly washing out the sinus, reported freedom from the asthma and an increase in weight; he was only troubled now by a slight cough at night, due to the bronchitis which so often follows sinusitis. Two days later he stated that, after washing the sinus twice a day for a month he had abstained for thirty-six hours from lavage, when a violent attack of asthma supervened, necessitating the use of morphine. This was an indication that the patient was sensitive to his own protein.

The anatomical condition in this patient explains why on two occasions the washings from the left side were negative, and how, although proof puncture had shown the presence of disease on the right side, yet a healthy sinus was found, but, when the partition was removed, a polypoid mucous membrane was exposed to view. I have previously reported the occurrence of similar anatomical anomalies of a less degree in two patients in China. The origin of supernumerary paranasal sinuses is discussed by Schaeffer. It would appear that the medial healthy sinuses originate from the naso-palatine canal, while the diseased sinuses are the true maxillary sinuses. In my case the condition was deceptive as the partition was complete. From the clinical aspect the history of asthma for only ten months pointed to a focus of infection somewhere, yet if transillumination had been omitted from the routine examination the focus would not have been discovered, for the patient had no idea that he had any lesion in his nose; there was no localized oedema or hypertrophy, and no discharge was seen near the middle turbinate. The condition is interesting, as the patient seems to have been sensitized to his own protein, and was always relieved by an adrenaline injection.

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