viscera becomes impossible. Anyone who has encountered conditions of this kind knows something of the difficulties to be faced in attempting to remove the disease. But should the attempt be made? It is not the difficulties which the surgeon fears to tackle, and can overcome with success, but the grave shock to the patient which supervenes, and which may of itself prove fatal. It is the possibility, and indeed probability, that our best efforts may be frustrated by fatal after-effects that should make us pause. There is this consideration also, that, in some inexplicable way, the exposure, and possibly the manipulation of the parts, involved in a simple exploratory laparotomy, causes the disease in some of these advanced cases to subside, and even disappear. For this additional reason, therefore, we should hesitate before submitting our patient to the extremely grave risks associated with the attempts to remove parts that are practically inseparably attached to each other and to the surrounding structures.

AMYL NITRITE AND THE TREATMENT OF HÆMOPTYSIS IN PULMONARY TUBERCULOSIS.

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IN the first number of this Journal Dr. Francis Hare discussed the treatment of hæmoptysis by amyl nitrite, to which he first drew attention in 1903.¹ He gives the literature of the subject up to that time, and he concludes that it is by far the best drug to administer for that condition. Since that article was published others have described their experience in the use of the drug, some fully confirming his results and deductions, whilst others have not had such a fortunate experience.

Cattle,² in discussing the treatment of hæmoptysis, considers that inhalations of nitrite of amyl are a more rational plan of treatment than the administration of adrenalin, etc., because the systemic vessels are of much greater extent than the pulmonary ones, and hence any general dilatation of the arterioles will be accompanied by diversion of the blood from the pulmonary circulation, and, consequently, there will be

¹ Hare, Francis: "Treatment of Hæmoptysis by Nitrite of Amyl." See also *Australasian Medical Gazette*, October, 1903.

² Cattle, C. H.: "The Treatment of Hæmoptysis," *British Medical Journal*, January 14, 1905.

a reduction of the pressure there. Hyslop Thomson¹ tried it in one case, but the inhalation was followed by coughing and increased flow of blood, though he is inclined to think that this may have been purely accidental. Branch² describes a case of profuse hæmoptysis where numerous *spirochaetes* were found in the sputum. He tried ergot, hazeline, adrenalin, and amyl nitrite, but the last named seemed to have the best effect in checking the bleeding. Herapath Wood³ uses nitrite of amyl in cases of profuse hæmoptysis as the first procedure, and if the patient survives the first few minutes, he sometimes gives a hypodermic of morphia to check coughing and to allay excitement. In ordinary cases he uses liq. trinitrini (1 min.) every two hours to lower the blood-pressure. Brown,⁴ in discussing the treatment of hæmoptysis by nitrites, considers that it is dangerous both to lower the blood-pressure too much as well as not to lower it sufficiently, so he takes the pressure every two hours, and attempts to keep it between 100 and 115 or 120 millimetres of mercury. He regulates his treatment according to the pressure, and says that amyl nitrite acts instantaneously, but the effect only lasts about five minutes, while nitroglycerine—as compared with sodium nitrite—acts more quickly and more intensely, but for a slightly shorter period. In a case of repeated daily hæmoptysis, where the quantity of blood brought up averaged nearly a pint per diem during eight days, Downes⁵ tried frequent inhalations of 3-minim capsules of amyl nitrite, but they appeared to have no effect, though the application of an icebag to the chest-wall over the diseased area caused the bleeding to cease.

In a paper on the subject early in 1907⁶ I discussed the treatment of hæmoptysis, and gave my (very favourable) experience of the action of the nitrite in about twenty-two attacks; whilst I also considered the action of the drugs usually employed for this condition.

In a lecture on "Some Medical Hæmorrhages," Leonard Williams⁷ expressed some very decided views on the subject. He stated that the only consequence of causing the inhalation of amyl nitrite is to induce a "widespread dilatation of the systemic vessels, with a considerable and rapid fall of arterial pressure," "but no necessary or even

¹ Thomson, H.: "The Treatment of Hæmoptysis," *British Medical Journal*, March 25, 1905.

² Branch, C. W.: "A Case of Hæmoptysis," *British Medical Journal*, December 1, 1906.

³ Wood, W. B. H.: "The Treatment of Consumption," *Liverpool Medico-Chirurgical Journal*, vol. xxvii., p. 66.

⁴ Brown: "The Treatment of Hæmoptysis by the Nitrites," *American Journal of the Medical Sciences*, August, 1906.

⁵ Downes, Harold: "Severe Hæmoptysis Treated by Means of the Icebag," *British Medical Journal*, June 29, 1907.

⁶ Crace-Calvert, G. A.: "Amyl Nitrite in Hæmoptysis," *Lancet*, April 6, 1907.

⁷ Williams, Leonard: "Some Medical Hæmorrhages," *The Hospital*, December 14, 1907.

probable consequential effect on the vessels in the pulmonary system." Hæmoptysis may be due to the rupture of a vessel in either the pulmonic or systemic system; and if the ruptured vessel be in the pulmonic system—*e.g.*, as in mitral stenosis—he says that amyl nitrite will certainly do no good. He also thinks that there is risk in giving it in tuberculosis generally, as the mean arterial pressure is low.

Now, physiologically I believe that he is wrong, as (1) Schäfer¹ has shown that it is impossible to cause a widespread dilatation of the systemic vessels without at the same time reducing the pressure in the pulmonary vascular system; and (2) in the experiments of Pic and Petitjean² on curarized dogs it was found that the injection of 1 c.c. of nitrite of amyl into the femoral vein caused in two or three seconds white patches to form on the surface of the lung. These patches steadily extended and coalesced, so that finally in two or three minutes the lung parenchyma became bloodless, and could be snipped with scissors without bleeding. This effect lasted several minutes. Now, wounds of the lung are usually followed by profuse hæmorrhage, so that such an extensive anæmia of the lung could not have been brought about by an action on the bronchial arteries alone, and must have been caused by an action on the pulmonary vessels as well.

Clinical records, too, are against Williams, for in almost every one of over 170 published cases inhalations of amyl nitrite have produced immediate cessation of the bleeding, and some at least of these cases must have been due to the rupture of a pulmonic vessel; and, indeed, one of the first cases published by Hare³ was that of hæmoptysis due to mitral insufficiency, where the bleeding had usually lasted for two to four days in previous attacks, and on this occasion was instantly checked by inhalation of one capsule of amyl nitrite. Again, in cases of profuse hæmoptysis, when the patient coughs up large quantities of blood in a few seconds, the bleeding can scarcely be from a bronchial vessel, but must come from a ruptured pulmonary vessel. In cases of this kind I have used the drug with excellent effect, as the following brief notes will show. The patient had advanced tuberculous mischief in both lungs, and had had many hæmorrhages at various times. On March 1 he had a small, sharp attack, which was followed during the next few days by several small attacks, all of which yielded promptly to inhalations of the nitrite. On May 8 he had another sharp hæmorrhage, which stopped at once after an inhalation, though he continued to bring up bright-coloured sputum for a couple of days, apparently from a recently formed cavity. On May 17 he brought

¹ Schäfer: "Text-book of Physiology," vol. ii., p. 150. 1900.

² Pic and Petitjean: "Comptes Rendus Hebdomadaires des Séances de la Société de Biologie." Quoted by Dr. Hare, *Lancet*, November 24, 1906, p. 1436.

³ Hare, Francis: "The Medical Treatment of Deep-seated Hæmorrhage" *Lancet*, August 20, 1904.

up $\frac{3}{4}$ pint of blood, and the attack ceased when he had inhaled 6 minims of the drug and had been given a hypodermic of morphia ($\frac{1}{4}$ grain). Next day, at 5 p.m., he brought up two or three mouthfuls of bright blood, and inhaled 3 minims of the drug. On May 19 he started a profuse hæmorrhage, and at once inhaled the contents of a 3-minim capsule, and was given another by the nurse. When I arrived a minute or two later he appeared to be dying, though the bleeding had ceased. His heart was beating irregularly and feebly, and his pulse was scarcely perceptible. I gave him a hypodermic injection of morphia, and he revived and vomited a quantity of blood which, with what he had coughed up, came to 2 pints. There was no further hæmorrhage, but he died ten days later from exhaustion. I am convinced that the nitrite saved him from immediate death on several occasions. So that I do not think that Dr. Williams has made out a good case against the use of amyl nitrite, though his opinion was based on two cases of hæmoptysis¹ due to tuberculosis, in both of which the exhibition of the nitrite was immediately followed by death; but it is only fair to add that one of the patients certainly, and the other possibly, would very shortly have died in any circumstances.

In criticizing the above statements of Leonard Williams, Reissmann² states that during the past three years he has treated at least ninety cases of hæmoptysis resulting from pulmonary tuberculosis by the immediate administration of amyl nitrite, and that, with few exceptions, the remedy was promptly effective. He has not known it to do any harm, and it certainly did not cause the death of any of his patients, whilst he has found it safer than morphia, to the use of which drug he ascribed the fatal result in two cases of hæmoptysis. Lundie³ has treated one case of profuse pulmonary hæmorrhage by the free administration of amyl nitrite on a towel, like chloroform, without any regard to the official dosage. He states that "the results were good, and a satisfactory recovery followed."

At a recent discussion before the Liverpool Medical Institution on a paper⁴ that I read on this subject most of the speakers agreed that the drug was of use in treating hæmoptysis, though many used it in conjunction with morphia. Sir James Barr spoke of the importance of avoiding any increase of blood-pressure in pulmonary tuberculosis, and had used the nitrites for cases of hæmoptysis. Nathan Raw did not agree that the drug had any specific action in the control of

¹ Williams, Leonard: "Amyl Nitrite in Hæmoptysis," *Lancet*, January 18, 1908.

² Reissmann, C. H.: "Amyl Nitrite in Hæmoptysis," *Lancet*, January 11, 1908, p. 130.

³ Lundie, A.: "The Free Use of Amyl Nitrite in Pulmonary Hæmorrhage," *Lancet*, February 8, 1908.

⁴ Crace-Calvert, G. A.: "The Treatment of Hæmoptysis by Nitrite of Amyl," *Liverpool Medico-Chirurgical Journal*, July, 1908. Summary in *Lancet*, February 22, 1908.

hæmoptysis, though he thought that by lowering the blood-pressure it might occasionally be useful. However, in a recent article on "The Modern Treatment of Tuberculosis by Drugs,"¹ he states that he has "had good results from the inhalation of nitrite of amyl." Buchanan pointed out that Nature's method of treatment in these cases was a lowering of the pressure, and therefore the use of the nitrite was a rational therapeutic measure, and the results justified its administration.

Philip² thinks that the blood-pressure should be gauged in order to determine the line of treatment, only using nitrite of amyl if the pressure be comparatively high; but, as Sir James Barr³ has pointed out, "blood-pressure is a purely relative term, and what might be considered a relatively high blood-pressure in pulmonary tuberculosis would be a low pressure in renal disease." Philip further thinks that "the routine treatment of hæmoptysis by amyl nitrite is to be deprecated."

In conclusion, the points in favour of amyl nitrite may be summed up as follows:

1. It acts instantly, producing an immediate fall in blood-pressure at the bleeding-point, thus giving time for clotting to take place, whilst the bleeding usually ceases at once.
2. It apparently produces an intense anæmia of the lung parenchyma, without any reactionary hyperæmia such as follows the use of adrenalin.⁴
3. It does not interfere with coughing, and so enables the patient to get rid of the effused blood as soon as possible, which might otherwise diminish the already impaired respiratory capacity, or lead to septic pneumonia or a rapid extension of the tuberculous mischief.
4. Capsules can easily be carried by the patient, who can then inhale the contents of one as soon as ever the hæmoptysis begins, thus treating the case at once, and so often preventing a worse attack. I usually give patients who have had one attack a capsule or two to carry about with them, as I consider it to be the most efficient drug in the treatment of such cases, and by far the best one to administer first.

¹ Raw, Nathan: "The Modern Treatment of Tuberculosis by Drugs," *Folia Therapeutica*, January, 1908.

² Philip, R. W.: "Pulmonary Tuberculosis," "Medical Annual," 1908, p. 588.

³ Barr, Sir James: Discussion on "The Treatment of Hæmoptysis by Nitrite of Amyl," *Lancet*, February 22, 1908, p. 565.

⁴ Crace-Calvert, G. A.: "Amyl Nitrite in Hæmoptysis," *Lancet*, April 6, 1907, p. 940. Hare, Francis: "Hæmoptysis and Nitrite of Amyl," *The Hospital*, December 28, 1907, p. 354.