standards, such as will debar as few promising candidates as possible and yet limit future risks. It cannot be too strongly urged that decisions in scholastic cases are decisions for a lifetime, and not merely decisions for the three years or so of military service. It is therefore better in every way to stop a dubious case at the very beginning, when a diversion of interest is easy, rather than to risk the grievous hardship of a stoppage in the future, with the possible wrecking of an established career.

REFERENCE.

¹ The Consequences of Myopia as an Industrial Disease of the Eyes, *Trans. Ophthalm. Soc. U.K.*, 1922.

THE EFFECT OF ANAESTHETICS ON THE LUNGS.

(Preliminary Communication.)

BY

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In the issue of this JOURNAL for November 11th, 1922, was published the report of the discussion at the Annual Meeting of the British Medical Association on broncho-pulmonary complications following operations under anaesthesia, and it was a strange coincidence that the succeeding article should be on the effect of anaesthetic vapours on tissues, in which Flemming has collected a very interesting series of experiments which show their detrimental effects on tissues and living organisms in general. In the first article stress was placed on the possible irritant effect of the vapours on the lungs; in the second no special emphasis was laid on the effect on the lung tissue.

It does not seem to be appreciated that the lung tissue may, apart from mere irritation, suffer serious damage as a result of actual contact with the vapour, apart from concentration in the blood.

Until quite recently knowledge of the function of the lung tissue was comparatively small, apart from the fact that the lungs were adapted for the supply of oxygen to the blood. The function of the bronchial muscles has been largely ignored and the physiology of the pulmonary circulation has been avoided, largely because of the experimental difficulty involved in its study and the negative results obtained by several well-known investigators. From book to book it had become quoted that the vasomotor mechanism in the lungs was negligible. Why there should be such an amount of muscular tissue in the lungs remained unexplained.

Much controversy centres round the action of adrenaline on the pulmonary circulation, as it is accepted that generally this drug acts only on tissues supplied by the sympathetic nervous system. While many observers have obtained negative or indefinite results, others, including Plummer, Starling, and Sharpey Schafer, have brought forward good evidence that adrenaline constricts the pulmonary vessels as it does the systemic. This suggests that the vessels have a sympathetic control, although in the light of more recent knowledge referred to below, this has not been reinvestigated.

By the introduction in 1919 by Sharpey Schafer of a convenient method of recording the pressure in the pulmonary artery new light has been thrown on the pulmonary circulation, and amongst the findings has been the fact that the effect of drugs which act on the circulation was greatly modified by anaesthetics.

I first noted that the effect of drugs on the pulmonary circulation would be much more easy to demonstrate on decerebrate animals, or animals under light ether anaesthesia, than on those anaesthetized with chloroform. For example, it was shown that the action of amyl nitrite on the pulmonary circulation can be prevented by deep anaesthesia. An investigation is in progress* to find out to what extent the functional activity of the lung tissue may be impaired by anaesthesia. It has already been shown that the action of histamine, now acknowledged to be a pulmonary constrictor (Dale and Laidlaw, Morris), may be similarly abolished.

There is evidence, too, that the action of adrenaline on the pulmonary circulation may be prevented while the systemic effect may be unaffected. This has occurred where all possibility of backward pressure through an incompetent mitral valve and cardiac effects have been excluded.

When the literature of the subject is surveyed it is found that the most probable reason for the negative or variable

results of different investigators, largely in the days when chloroform was in more common use, was the effect of the anaesthetic. The effect of anaesthetics is not necessarily excluded in lung perfusion experiments, as the animal is under an anaesthetic immediately prior to death, and with the cessation of blood supply and anaesthetic the anaesthetic has all the better chance to produce its bad effects. In the positive experiments of Sharpey Schafer and of Starling, referred to above, volatile anaesthetics were not used except in the preliminary anaesthetization, but chloral and chloralose respectively.

This is not the first time that attention has been drawn to the action of anaesthetics on the lungs. In this JOURNAL, in 1880, McKendrick, Coats, and Newman described complete stoppage of the pulmonary circulation of the frog as the result of chloroform anaesthesia, with actual destruction of the lung epithelium.

When the evidence put forward by Flemming is considered, the importance of the local effects of anaesthetics on the lungs will be seen. He might also have added to his list the fact that a piece of muscle exposed to chloroform vapour is killed with great rapidity, a fact which is made use of in the thermopile experiments of Hartree and Hill on heat production.

My results so far agree with those of Flemming on isolated tissues. Recovery from the pulmonary effects occurs after ether, but after deep and prolonged anaesthesia with chloroform recovery is the exception. The actual death of tissue in the lungs as a result of the anaesthetic does not appear to be a remote possibility—indeed, may be easily considered the natural sequel. It is outside the scope of this paper to consider the evil results of such lethal action, but obviously the symptoms discussed at the Glasgow meeting might readily follow. That the absorption of toxic products from such dead tissue should produce delayed chloroform poisoning seems most reasonable.

Another function shown to be abolished is that of the bronchioles, which limit the amount of air passing in to the alveoli. Brodie and Dixon first demonstrated that the vagus no longer caused bronchiole constrictions under deep anaesthesia. The muscles or their nerve supply were considered to be paralysed by direct absorption of the anaesthetic through the mucous membrane. I have demonstrated that the action of adrenaline on the bronchioles may similarly be prevented by deep anaesthesia.

Now the abolition of the bronchiole function must necessarily throw a greater strain on the alveoli and cause them to be exposed to particles which otherwise would not reach them. Even if actual death of tissue does not occur, the mere loss of this protective mechanism temporarily must expose the lung to possible damage.

The investigation is proceeding, but from the results already obtained it is seen that the local effects of the common anaesthetic cannot be ignored, not only from the purely experimental standpoint, but also from that of the clinician. Although anaesthetics may be given to thousands of cases yearly without effect, it must be urged that we are still without an ideal anaesthetic for general use.

From the evidence given it is seen that deep or prolonged anaesthesia with ether, and especially with chloroform, should be avoided whenever possible. It is suggested that narcotics should be more extensively used to supplement volatile anaesthetics.

INTESTINAL OBSTRUCTION FOLLOWING ACUTE APPENDICITIS AND PERITONITIS.

BY

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In the case here reported adhesions must have begun to form immediately after the first operation. The second operation was undertaken because of the increasing distension and in spite of the fact that there was no vomiting and that the patient's bowels had moved on the previous day. The part of the ileum opened on the fifteenth day was below the site of obstruction, which had been liberated at the second operation; the opening acted simply as a safety valve, and by relieving distension allowed the intestines to recover tone.

On February 6th, 1922, a man aged 20 was sent in to Stirling suffering from acute appendicitis. His illness had started suddenly thirty hours, approximately, before admission. When I first saw

* The research is being assisted by a grant from the British Medical Association.