to operative stimuli, such as movements of the limbs or face, laryngeal activity, respiratory changes, rise in pulse rate, and other phenomena. Any desired supplement may be used, according to the preference of the anaesthetist, such as low concentrations of trichlorethylene ("trilene"), "vinesthene," ether, or even cyclopropane (100–200 ml.); alternatively, further intermittent injections of thiopentone or injections of pethidine may be given. If trichlorethylene or ether is used it is only necessary to raise the lever of the Boyle's bottle to the top of the second division, plunger up. Changes in cardiac or respiratory rhythm are extremely rare when trichlorethylene is used, and this is probably the most useful supplement, as it is non-explosive and has a very potent analgesic action.

Should the patient's tidal exchange become inadequate for his metabolic requirements some degree of cyanosis will usually follow if his blood haemoglobin is normal, since the concentration of oxygen in the inhaled mixture approximates to that of atmospheric air: this is a safeguard against carbon dioxide accumulation in the patient which may follow shallow breathing—another common cause of increased operative bleeding. Cyanosis may be remedied by one of several methods: by increasing the rate of flow of oxygen or decreasing the rate of flow of the nitrous oxide, by adding 500 ml. of carbon dioxide to the flow of gases, by changing to a semi-closed circuit, and by assisting respiration by bag-pressure. These measures should not, however, be prolonged, as they will detract from the benefits of the technique, particularly as regards the quantity of operative bleeding.

Should the patient's breathing become too deep there will be a danger that air may enter his lungs, which will in turn be followed by a rapid lightening of anaesthesia, so that immediate action is called for. An injection of thiopentone will usually have the desired effect, but if this is not possible the flow of nitrous oxide should be raised temporarily to 8 litres, the concentration of supplementary agent increased, or perhaps an injection of pethidine made. If the depth of breathing is not soon decreased it is advisable to change to a semi-closed circuit until the patient comes under control, lest he should return to consciousness. The addition of a second length of rubber hosing to the expiratory side of the apparatus will also help to prevent entry of air into the lungs.

A rather useful point about this technique is that, by the simple expedient of applying the open end of the rubber hosing to his ear, the anaesthetist is able to listen to every breath that the patient takes; thus positive proof is continuously available that the patient is breathing adequately through a clear airway, or otherwise, as the case may be. This should be very useful during intracranial operations.

The technique has the disadvantage that comparatively large quantities of gases are used; but then these are very cheap compared with intravenous drugs. There is also the inconvenience of changing cylinders. Body heat and water vapour are lost by the patient to the atmosphere; but this loss is a totally normal occurrence, and is no greater than in normal breathing, and can scarcely be said to be harmful.

In addition to the advantages already mentioned, this technique makes the use of nitrous oxide and oxygen, with truly minimal quantities of supplementary agents, a practical proposition when the patient is a small child, and it has been safely and satisfactorily used on patients

as young as 1 year old. This is perhaps because there is the minimum of interference with normal physiological breathing. In this respect the technique compares favourably with open-mask techniques, and is recommended to those anaesthetists whose surgical colleagues insist on the use of "open ether" for such operations as thyroidectomy.

Summary

The use of the T-piece principle of inhalational anaesthesia is offered as a safe and satisfactory method of reducing operative bleeding.

Ayre's T-piece technique is briefly described and its disadvantages are mentioned.

A technique which overcomes these disadvantages is described.

An account is given of two simple ways of converting standard apparatus to the T-piece principle. No additional apparatus is necessary, but endotracheal intubation may be used. Nitrous oxide is the main agent; air can be excluded from the inhaled mixture. A change to or from a semi-closed technique can be accomplished rapidly.

The technique may be used for adults or children, and for any type of surgical operation.

The applied physics of the technique is outlined.

As an illustration, a typical anaesthetic for a patient undergoing a mastectomy is described.

REFERENCES

- Ayre, P. (1937a). *Lancet*, **1**, 561.
— (1937b). *Anesth. & Analg.*, **16**, 330.

Medical Memorandum

Leukaemia With Primary Gynaecological Manifestations

Although leukaemia in association with pregnancy has been reported and discussed in many recent papers, a search of the *Quarterly Cumulative Index Medicus* shows no report in recent years dealing with leukaemia from the gynaecological aspect. Therefore the admission to one hospital of three such cases as acute gynaecological emergencies in a short period appears to be worthy of record.

Case 1

An unmarried woman aged 22 was admitted on April 17, 1947, at her doctor's request as a case of pneumonitis complicated by abortion. She stated that she had had a cough all her life, that it had been worse for the past month, with pain in the right side of the chest, night sweats, but no sputum. Menstruation had always been normal and regular, but she had bled severely from the uterus for seven days preceding admission to hospital.

She was pale, weak, and very ill. Her blood pressure was 130/60. A faint macular eruption was present on both legs, from the thighs to the ankles. There were signs of consolidation at the right base of the lungs, and the tip of the spleen was just palpable. On rectal examination the cervix and uterus appeared to be normal. An immediate blood count was as follows: red cells, 2,350,000 per c.mm.; Hb, 40%; C.I., 0.79; blood group, A; white cells, 1,075 per c.mm. (polymorphs 33%, lymphocytes 64%, monocytes 3%); platelets very scanty; nucleated red cells, 25 per 100 white cells; bleeding time 10 minutes (normal by method used 1–2 minutes). A film of sternal marrow was reported as showing "great reduction in white blood cells; only a few polymorphs and myelocytes seen in many fields. There are a fair number of nucleated red cells of rather early

type." X-ray films of the chest showed "consolidation of lower portion of right upper lobe." Sputum report: "No tubercle bacilli seen in three specimens." Culture: "*Staphylococcus aureus* and *Micrococcus catarrhalis*."

Repeated blood transfusions caused no change in the blood picture, each transfusion appearing to restart uterine bleeding. On May 26 a complete left-sided facial palsy developed. On June 13 x-ray examination showed complete resolution of the consolidation in the right lung. On June 14 the blood picture suddenly changed: red cells, 5,360,000 per c.mm.; Hb, 82%; white cells, 292,000 per c.mm. (neutrophil polymorphs 3%, eosinophils 1%, lymphoblasts 4%, myeloblasts 92%); a few nucleated red cells present; platelets very scanty.

Treatment was started with urethane, but on June 25 there was complete nasal obstruction from oedema and haemorrhage into the nasal mucous membrane, haemorrhages into both conjunctivae and the soft palate, and considerable enlargement of all the groups of glands in the neck. The patient died on July 7. A post-mortem examination was refused.

Case 2

A housewife aged 40 was admitted on September 2, 1948. She was sent to hospital with a letter from her own practitioner which stated: "Please admit. Severe uterine haemorrhage for five months. Confined nine months ago." She was seen by the gynaecological registrar, who reported: "Looks pale, thin, and ill. Abdomen N.A.D.; a few small glands both groins. P.V.: heavy loss. Cervix soft and patulous, feels and looks quite healthy. Uterus soft, bulky, and anteverted. Fornices clear. May be incomplete abortion, or placental polypus, or chorionepithelioma. For diagnostic dilatation and curettage when general condition better."

She was admitted to a ward, where a general examination showed no abnormality, except that the tip of the spleen was just palpable. A blood examination was made and the report was as follows: red cells, 900,000 per c.mm.; Hb, 22%; platelets very scanty; white cells, 8,200 per c.mm. (polymorphs 7%, lymphocytes 37%, myelocytes 3%, myeloblasts 53%). Sternal puncture: myeloblasts, 75%; neutrophil myelocytes, 9%; eosinophil myelocytes, 7%; polymorphs, 5%; eosinophils, 1%; basophil normoblasts, 3%; polychromatic normoblasts, 2%.

Repeated blood transfusion and deep x-ray therapy were given. The patient went home at her own request on October 6. She gradually deteriorated and died about three months later.

Case 3

An unmarried woman aged 22 was admitted on April 1, 1949, as a case of "uterine haemorrhage with slight haematemesis." On admission she said that her menstrual period had begun 14 days previously and had continued ever since. She had always bruised easily. One week before the onset of the last period her gums had bled; this was followed by an abscess in the region of the upper left molar teeth which had subsided after penicillin injections. She had started to vomit small flecks of blood-stained material on the morning of the day of admission. Further, she had previously attended two other hospitals for severe dysmenorrhoea with excessive blood loss. One of these hospitals informed us that in March, 1946, her haemoglobin had been 94%, white cells 7,000 per c.mm., with a normal differential count. The other said that in January, 1947, she had had a haemoglobin of 104%.

She was pale, with a marked gingivitis. The lungs, abdomen, and central nervous system showed no abnormality. There was a harsh systolic murmur in all the cardiac areas. A blood examination was made immediately on admission: Hb, 40%; white cells, 28,800 per c.mm. (polymorphs 20%, lymphocytes 12%, metamyelocytes 2%, myelocytes 6%, myeloblasts 60%); nucleated red blood cells, 6 per 100 white blood cells; platelets very scanty. Sternal puncture confirmed the picture of an acute myeloblastic leukaemia.

Repeated blood transfusions and urethane were given, and, although the white-cell count dropped to 8,800 with only 5% myeloblasts, the clinical course was one of steady deterioration, with haemorrhages in the optic fundi and large haemorrhages all over the body. She died five weeks after admission.

At necropsy the spleen was of normal size, the liver large and infiltrated, and the bone marrow everywhere replaced by a soft pink material.

Comment

Most textbooks of haematology and of gynaecology make but brief reference to the possibility of leukaemia as a cause of uterine bleeding. Thus Whitby and Britton (1946) state regarding leukaemia, "Multiple haemorrhages in the retina, ear, spinal cord and brain, or from the uterus, kidney, or bowel, may all be found," but state, further, that "in myelocytic leukaemia, amenorrhoea or scanty menstruation is common." Moore White (1944) says: "Uterine haemorrhage may be a symptom of most of the blood diseases." Browne (1950) comments more fully: "Such blood diseases as splenic anaemia, idiopathic hypochromic anaemia, aplastic anaemia, leukaemias, and thrombocytopenic purpuras may be associated with menorrhagia. Secondary thrombocytopenia arising from malignant neoplasms, leukaemia, septicaemia, arsenical poisoning, and x-ray or radium therapy may so depress that bleeding time is prolonged and menorrhagia may occur." It is to be noted that in all three cases described the platelets were very scanty. Several other standard textbooks consulted make no reference to the possibility of uterine haemorrhage being caused by leukaemia.

This hospital, being one of the former municipal hospitals of London, has always received large numbers of cases of uterine haemorrhage, the greater number of which prove to be due to abortions; in fact, 550 cases of abortion were admitted during the period covered by the three cases described. The occurrence of cases such as these points to the urgent need for a full blood examination in all cases of uterine haemorrhage, before the almost inevitable dilatation and curettage operation is performed, particularly when the patient is exsanguinated or when there is any haemorrhage into the skin or from any other unexpected site. In such cases the operation cannot be expected to be of any benefit to the patient, but would only be an additional and major discomfort in the course of a most distressing illness.

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REFERENCES

- Browne, F. J. (1950). *Post-Graduate Obstetrics and Gynaecology*, p. 260. London.
Whitby, L. E. H., and Britton, C. J. C. (1946). *Disorders of the Blood*, 5th ed., pp. 416, 422. London.
White, M. Moore (1944). *The Symptomatic Diagnosis and Treatment of Gynaecological Disorders*, p. 57. London.

The 1951 *Register of Chiropodists* has just been published by the Board of Registration of Medical Auxiliaries listing the names, addresses, and qualifications of chiropodists recommended by the Board to the medical profession, hospitals, education authorities, etc. It is available free to members of the medical profession, hospitals, and official bodies; application should be made to the Registrar, Board of Registration of Medical Auxiliaries, B.M.A. House, Tavistock Square, W.C.1.