damaging Bartholin's duct, and good apposition is most easily obtained. The obvious danger of this method is that, should the opening still be insufficient, the resulting tear will be directed through the sphincter towards the rectum, thus bringing about the major disaster that must be avoided; and who can always be certain that the central incision will be adequate? Gillis (1930), describing 500 consecutive cases of median episiotomy performed by him, stated that extension into the rectum occurred in 8 cases (1.6%). Thus even in skilled hands there is a definite danger of this happening, which danger will increase markedly, with a less experienced operator. It is in order to avoid this danger that the lateral episiotomy of to-day is so widely used. Starting in the midline, it extends laterally towards a point midway between the anus and the ischial tuberosity. A large incision can be made, and even if extension occurs there is no risk of rectal involvement.

Personally, I attempt to combine the advantages of both median and lateral episiotomy. A blunt-pointed curved pair of scissors are used, and the incision made in the midline, until it reaches a point 1 in. from the anterior margin of the anus. The scissors are then directed towards the ischial tuberosity and the incision completed with the curved portion. In this way the sphincter is avoided, and, should the incision extend, there is no rectal involvement.

In rare cases, in which even a large lateral incision seems inadequate, Taylor (1937) and others advocated bilateral episiotomy. This should never be done, for in this way almost the whole of the blood supply to the perineum is cut, since it comes from the lateral borders; and personally I have seen two cases of severe perineal sloughing result from this operation. Both these were clean cases, performed in hospital, and are the only serious complications I have seen resulting from episiotomy itself.

Already it has been stated that episiotomy should be practised more frequently, and earlier in the second stage, than it usually is. Whenever it is done it should be performed at the height of a pain, for then the tissues are stretched and it is easier to see exactly where the incision is being placed. Furthermore, sensation in the part is then dulled: even if no anaesthetic is being used—a rare occurrence—the operation does not seem to be unduly painful, and the Junker or "gas-and-air" apparatus can make the patient oblivious of the fact that the tissues are being incised; or the incision can be made very satisfactorily under local analgesia. Whatever incision is being adopted in manipulative cases, it is advisable to "iron out" the vagina with the well-lubricated hand before making the incision, and in all cases essential to divide the whole depth of tissue in the wound, and not merely to incise the skin.

Results

In 135 consecutive primigravid private patients delivered per vaginam I find the following results:

Normal delivery without episiotomy, 63 cases	46.7%
Episiotomy performed in 72 cases	53.3%
Of the episiotomy cases 52 had a normal delivery, and therefore the total normal delivery rate (115 cases in 135) is	81.1%
Among the remainder, all of which had episiotomy performed, there were 17 forceps deliveries	12.6%
The remaining 3 cases comprised 2 extended breech and 1 perforation of a hydrocephalic head	

The relatively low forceps rate for primigravidae in private practice I attribute almost entirely to the episiotomy rate of over 50%.

Apart from the case of hydrocephalus, all the babies were alive and well, with the exception of one delivered by forceps, which died on the sixth day from pneumonia. Post-mortem examination showed no cerebral haemorrhage. Of the 72 episiotomy cases, 2 (2.8%) had symptoms referable to vaginal hernia 6 months later; but these were slight, and improved with palliative treatment, whereas of the 63 cases of normal delivery without episiotomy, 5 (8%), one of whom had colporrhaphy performed, had the same symptoms.

Apart from these figures the average "tone" of the vaginal walls was much better in the former group than in the latter.

A patient always thanks her doctor if she has no stitches in the puerperium. Instead, should she not thank him because she has?

Summary

The disadvantages of a torn perineum are discussed and compared with the disadvantages of unseen damage that may occur as a result of keeping the perineum intact.

In order to minimize all these disadvantages early episiotomy is advocated, and the cases in which episiotomy should be performed are stated.

The relation of injury sustained during labour to prolapse and vaginal hernia is discussed.

Certain perineal anatomical points of practical importance in performing episiotomy are mentioned.

The methods of performing episiotomy are described.

Figures are given which indicate that patients on whom early episiotomy is carried out are less prone to pelvic damage than those in whom the perineum remains intact.

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RAPID REPLACEMENT OF FLUID IN HAEMORRHAGE AND SHOCK

BY

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Although numerous papers on the effects of transfusion of the human subject with blood and blood substitutes have appeared in the last five years very few refer to the hazards of overloading of the circulation with fluid. Black (1937) states that 20 minutes should be taken in introducing 600 c.cm. of blood, otherwise an acute dilatation of the right side of the heart may be encountered; while Brennan (1940) suggests that 500 c.cm. of plasma in 20 minutes may be considered rapid. Marriott and Kekwick (1940) state that 568 c.cm. of blood in 30 minutes is usual, and distinguish between this rate of infusion and that desirable in debilitated patients (1 c.cm. per lb. wt. per hour), in whom, according to Murphy, Grill, and Correll (1940), injection of relatively small amounts of fluids by vein causes increase in the venous pressure and slowing of the circulation. De Gowin and Hardin (1940) gravity-fed from 5 to 40 c.cm. of fluid a minute to their cases with success. Dealing with battle casualties, Whitby (1942) states that failure to restore blood volume is a much greater danger than pulmonary oedema from necessary massive transfusion (experience of 150 cases), while Kilduffe and DeBailey (1942), quoted by Drummond (1943), have given 650 c.cm. in 3 minutes, and the latter says he may have to give 568 c.cm. in 15 minutes, without ill effects. Sharpey-Schafer and Wallace (1942) deal specially with the question of possible overloading of the circulation from rapid infusion of fluid in man. Of 10 subjects with normal cardiovascular apparatus given up to 2,000 c.cm. of serum at a rate of 54–100 c.cm./min., 5 developed headache or constriction of the chest; 3 had slight changes in the T-wave of the electrocardiogram, their pulse rates increased slightly, and the haemoglobin fell by 3.3 to 23.3%. If the haemoglobin fell markedly there was a rise of venous pressure, with an increase in the diastolic size of the right heart, but no pulmonary oedema. In 9 cases which had a venesection of 740–1,100 c.cm. (approximating to battle casualties) followed by infusion of 1,500–1,800 c.cm. of 0.9% saline at a rate of 88–138 c.cm./min., or an infusion of 700–2,000 c.cm. of serum at a rate of 6–140 c.cm./min., the most striking effect was vasodilatation, with reddening of the face and engorgement of superficial veins. Unless enough time had elapsed for the haemoglobin to fall considerably, no rise in venous pressure followed infusion until at least 1,000 c.cm. of fluid had been given.

Brewer, Maizels, Oliver, and Vaughan (1940) state that there is no apparent association between either the amount of blood given and the risk of reactions or the rate of administration and the risk of reactions: Edwards, Kay, and Davie (1942) state that it is rare for a patient to lose more than 3 pints of blood, as the fall of blood pressure in such cases is so great that the haemorrhage ceases; while Keith (1919) declares that a systolic pressure of 70–80 mm. Hg indicates a loss of 30% of the blood volume, and a pressure below 60 mm. Hg a loss of over 35%—i.e., 2,100 c.cm.

It was decided to increase the quantity and the rate of fluid infused into a series of battle casualties dealt with in a mobile A.D.S. in the Mediterranean theatre of war, and to observe the cases closely for ill effects on the heart and circulation in the lungs. Cases were received at very variable periods after wounding 1/2–22 hours in the selection reported; all had been fit men, young, highly trained, and well fed; all were suffering from physical fatigue, a degree of anxiety neurosis, dehydration, and the effects of severe trauma and blood loss; all received 3,000 units A.T.S. intramuscularly and 2.5 g. sulphanilamide by mouth in addition to other treatment. Resuscitation measures consisted chiefly of control of haemorrhage, dressing and immobilization of wounds with the minimum of disturbance, morphine, sweet tea, and warm venous infusions, supplemented by the application of hot-water bottles and blankets. Infusion fluids were administered under pressure created by attaching a Higginson syringe to the air inlet of the standard giving set. The cases were German and Italian P.O.W. and British troops.

Case Histories

Case 1.—Aged 22. Shell splinter, amputation of R. foot just above ankle, with severe blood loss, about 45.30 hours. Given morphine 1/2 gr. s.c. at 17.10 hours; received 18.40 hours; T. 97.2° F., P. 110, R. 14, B.P. 80/?; Hb 90%. Mentally confused; hands clammy; no urine passed. Heated with bottles; limb dressed and fixed in wire box-splint. By this time he was semicomatose. Transfused with four 600-c.cm. bottles of reconstituted plasma in 20 mins., when the blood pressure rose—85/45, 100/50, 105/55, 105/50—and the pulse rate was 130, 130, 120, 124, thready at first, then stronger. Heart sounds became drumming and lungs remained clear. Five minutes after the last bottle his state was: T. 98.4° F., P. 124, R. 10, B.P. 110/50, Hb 58%. Had a good night; lungs and heart normal. At 08.30 hours, B.P. 95/50, T. 102° F., P. 180, R. 32. Blood volume, 4,350 c.cm.; estimated loss, 1,650 c.cm.; infused 50% of volume on reception.

Case 2.—Aged 27. Bomb wound, compound fracture L. femur, with severe flesh and blood loss, at 10.15 hours. Given morphine 1/4 gr. sublingual 10.20 hours, 1/4 gr. s.c. 10.45 hours. When received T. 97.4° F., P. 92, R. 14 (sighing), B.P. 90/10, Hb 104%; mentally clear and apprehensive; hands cold and dry; no urine passed. Given tea and morphine; local dressing of wound with Tobruk plaster (Thomas splint), by which time he was collapsed. Transfused with four 600-c.cm. bottles of reconstituted plasma in 18½ mins., when the B.P. rose from 100/45, 110/60, 120/65, to 140/60, and the pulse rate was 90, 110, 116, 120. During infusion of the first 600 c.cm. the patient complained of tingling of face and hands, and towards the end of the fourth bottle he developed a pain in the wound and across the chest at the nipple level. The heart sounds remained normal throughout. After 5 mins. his state was: T. 99.2° F., P. 98, R. 20, B.P. 140/60, Hb 68%. The patient arrived M.D.S. at 13.05 hours: condition good; T. 100° F., P. 110, R. 20, B.P. 120/68; no pulmonary oedema. Blood volume on reception, 4,533 c.cm.; loss, 1,467 c.cm.; infused 50% of volume after wound.

Case 3.—Aged 20. L.M.G. bullet wound penetrating arch of L. foot, with fracture and haematoma, considerable blood loss, at 13.00 hours. Picked up 14.20 hours; received 14.30 hours and given morphine 1/2 gr. s.c. T. 97.2° F., P. 110, R. 16, B.P. 70/?; Hb 96%; comatose; hands cold and clammy; no urine passed. Given morphine, heat, tourniquet (10 mins.), and tight dressing to control ooze. Transfused with five 500-c.cm. bottles of reconstituted plasma in 32½ mins., when the B.P. rose from 90/40, 105/50, 128/40, 140/60, to 140/75, and the pulse rate was 132, 128, 110, 116, 120. At first thready, the pulse became strong and the patient was restless during the infusion of bottle 3. During the infusion of bottle 5 the neck veins became engorged, the face flushed, and the heart sounds drumming. Final state (5 mins.) was: T. 99° F., P. 120, B.P. 132/75, Hb 64%; congestion less; lungs clear; heart sounds normal. Arrived M.D.S. 18.25 hours: T. 99.6° F., P. 100, R. 18, B.P. 128/70; no congestion. Blood volume on reception, 5 l.; estimated loss, 1 l.; infused 50% of volume after wound.

Case 4.—Aged 33. Shell wounds both legs, no fractures, but severe blood loss, at 12.15 hours; given morphine 1/4 gr. i.v., 1/4 gr.

i.m., at 17.00 hours. Received 18.30 hours; T. 97.4° F., pulseless, R. 12, B.P. 85/40, Hb 90%; comatose; hands cold; passed 120 c.cm. urine at 02.00 hours. Dressing not changed; given heat; no improvement. Transfused with four 600-c.cm. bottles of serum in 21 mins., during which the B.P. rose from 90/50, 110/50, 150/95, to 155/110, and the pulse rate was 120, 104, 120. Towards the end of the last bottle the neck veins were engorged and slight irregularity of the heart sounds like coupling appeared, which died away after 10 mins. Final state: T. 98.4° F., P. 112, R. 12, B.P. 160/110, Hb 62%. Kept overnight; next day, at 06.30 hours, T. 99.8° F., P. 100, R. 14, B.P. 110/50; lungs clear. Arrived M.D.S. 08.00 hours: T. 100° F., P. 110, R. 12, B.P. 115/70; no congestion. Blood volume on reception, 5,311 c.cm.; estimated loss, 689 c.cm.; infused 47% of volume on reception.

Case 5.—Aged 27. Shell wounds legs, extensive loss of flesh and blood from thighs, at 07.30 hours; given morphine 1/2 gr. by mouth at 07.35 hours, and 1/4 gr. s.c. at 12.00 hours. When received, T. 100.4° F., P. 80, R. 14 (sighing), B.P. 105/60, Hb 95%; mentally apprehensive; cold and clammy. Given tea, when he had nausea; felt the worse for treatment. Transfusion of three 600-c.cm. bottles of serum in 19 mins., when B.P. rose from 105/70, 110/80, to 140/60, and pulse rate from 80, 104, to 108. During infusion of the first bottle there was a short rigor for 30 seconds, repeated during bottle 3, when a tight pain across the chest developed towards the end. Final state (5 mins.): T. 99.6° F., P. 96, R. 24, B.P. 140/65, Hb 67%; lungs clear. Arrived M.D.S. 14.30 hours: T. 102.6° F., P. 120, R. 24, B.P. 140/65; lungs clear. Blood volume on reception, 4,307 c.cm.; estimated loss, 1,693 c.cm.; infused 39% of volume.

Case 6.—Aged 25. L.M.G. bullet compound fracture tibia and fibula, moderately severe blood loss, at 16.30 hours; given morphine 1/2 gr. at 17.00 hours on admission. T. 97.4° F., P. 90, R. 14, B.P. 145/85, Hb 110%; hands cold and damp; mentally clear. Tight dressing and box splint applied; kept overnight at A.D.S. At 01.00 hours, oozing having occurred, T. 96.5° F., P. 130, R. 12 (sighing), B.P. 75/?; Hb 94%. Transfusion four 500-c.cm. bottles of reconstituted plasma, when B.P. rose from 95/40, 105/55, 110/60, to 125/65, and pulse from 130, 128, 124, to 124. Final state (5 mins.): T. 99.8° F., P. 120, R. 18, B.P. 120/65, Hb 70%. No pulmonary oedema; heart sounds normal. Evacuated in good shape; arrived M.D.S. 08.30 hours: T. 100° F., P. 124, R. 16, B.P. 110/60. Blood volume before transfusion, 4,859 c.cm.; loss, 1,141 c.cm.; infused 37% of volume.

Case 7.—Aged 25. Shell wound L. buttock, penetrating abdomen, with moderate blood loss, at 11.30 hours. Given 3/8 gr. morphine 12.05 hours; admitted 14.30 hours. T. 96.8° F., P. 120, R. 18, B.P. 95/50, Hb 98%; hands cold, dry; anxious mentally. Simple dressing with abdominal binder. Transfused two 500-c.cm. bottles of serum in 12 mins., when B.P. rose from 110/55 to 115/55 and pulse steadied from 125 to 110, with relief of abdominal pain. Final state (5 mins.): T. 97.8° F., P. 110, R. 16, B.P. 115/58, Hb 80%. Arrived M.D.S. 17.20 hours: T. 98.4° F., P. 110, R. 16, B.P. 96/60; pale but no air hunger. At operation about 2 pints of blood in abdomen. Blood volume on reception, 4,444 c.cm.; loss, 1,556 c.cm.; infused 22.7% of volume.

Case 8.—Aged 27. Mine splinter penetrating L. iliac fossa, with internal haemorrhage, about 16.30 hours. Picked up next day at 11.30 hours; given 3/8 gr. morphine s.c. at 14.00 hours. On reception, T. 97.8° F., P. 130, R. 26, B.P. 45/?; Hb 90%; hands warm; urine nil; delirious. Given heat, morphine, simple dressing, when restlessness subsided and flexed L. leg relaxed. Transfused six 400-c.cm. bottles of reconstituted plasma in 23 mins., when B.P. reacted as follows: 105/62, 105/70, 95/66, 108/70, 95/70, and 90/70, and pulse fell from 160, 158, 146, 140, 140, to 128. No cyanosis, engorgement, or pulmonary oedema occurred, but pulse and heart sounds were of better quality after bottle 2 than after bottle 6. Received at M.D.S. 17.00 hours: T. 102° F., P. 160, R. 40, B.P. 95/40; cyanosis of lips; rales at both bases. Blood volume on reception, 4,800 c.cm.; loss, 1,200 c.cm.; infused 50% of volume.

Case 9.—Aged 37. Crush wound of abdomen (? rupture spleen) at 07.30 hours. Admitted 07.55 hours; given morphine 1/4 gr. s.c.; T. 98.2° F., P. 120, R. 20, B.P. 90/40, Hb 110%; drowsy; hands warm. Given heat, tea, elastoplast to lower L. ribs; became paler, respiration sighing. Transfused after 1/2 hour with three 600-c.cm. bottles of reconstituted plasma in 15 mins. B.P. rose from 98/50, 100/60, to 100/60, and pulse from 106, 104, to 110; lungs clear; heart sounds normal. Final state (5 mins.): T. 98.6° F., P. 112, R. 22, B.P. 70/?; Hb 72%. Arrived M.D.S. 11.35 hours: T. 97.4° F., P. 140, R. 14, B.P. 70/?. Given drip transfusion whole blood and sent on; died before arrival. Blood volume on reception, 3,410 c.cm.; loss, 2,590 c.cm.; infusion of 55% of volume.

Case 10.—Aged 21. Shell wound of chest with haemopneumothorax and compound fracture of humerus, ? penetrating wound of abdomen, at 07.30 hours. Received 09.00 hours: given 3/16 gr. morphine; T. 96.2° F., P. 128, R. 22, B.P. 75/10, Hb 80%; hands clammy; drowsy. Transfused two 600-c.cm. bottles of serum in

20 mins. During bottle 1 the pulse became stronger, B.P. 90/20, R. 40, P. 132; but during bottle 2 he developed a severe pain in the chest and abdomen and felt bubbling and splashing in the chest. Final state (5 mins.): T. 97° F., P. 120, R. 40, B.P. 95/20, Hb 60%. Received M.D.S. 14.30 hours: T. 101.6° F., P. 130, R. 40, B.P. 80/40; condition poor. Sent on with whole-blood drip. Died that night. Blood volume on reception, 3,600 c.cm.; estimated loss, 2,400 c.cm.; infused 33% of volume.

Discussion

The 10 cases reported in detail are considered typical of a larger number treated. The majority of battle casualties suffering from shock are not so exsanguinated, and do well with 1,000 c.cm. of blood substitute transfused in 20 to 30 minutes, preferably being evacuated with a continuous drip running; but where the blood loss is estimated to be severe (about 2 litres) replacement cannot be too speedy. Analysis of the cases on the basis of the formula of Bushby *et al.* (1940) indicates that they lost 1.54 litres of blood on an average, and this was replaced as quickly as possible with some excess to allow for oozing and loss of serum from damaged surfaces, to the extent of 33% of the intact volume or 43.4% of the blood volume after wounding. The incidence of reactions with rapid transfusion seemed less than that found when small quantities of fluid were given slowly (1/2 hour to 1 pint). Where sufficient time had elapsed for the haemoglobin to fall considerably there appeared to be no more signs of overloading of the circulation than in fresh cases; but what was most marked, and is clearly brought out in the case histories reviewed, was that cases of embarrassment of the cardiovascular system from toxæmia (Case 8), damage to the thoracic contents (Case 10), or continuing internal haemorrhage (Case 9) do badly with rapid transfusion. The ideal case for this technique is one of trauma to the limbs with gross haemorrhage. Perhaps cases of internal haemorrhage not involving gross toxæmia would do equally well if haemostasis were secured by operative means shortly after wounding.

It is widely held (Moon, 1938) that even in profound shock the heart is capable of functioning strongly, and if supplied with enough fluid can produce a normal or higher than normal blood pressure. Shock is defined as a state of circulatory deficiency, neither cardiac nor vasomotor in origin, characterized by decreased blood volume, decreased cardiac output, and increased concentration of the blood. Shock may be produced by trauma, etc. (when haemoconcentration takes place), or by haemorrhage (which is followed by haemodilution, fall in Hb and in r.b.c. count), or by a combination of these factors.

According to Moon *et al.* (1941) the effects of haemorrhage and of shock should be clearly distinguished. The initial similarity between shock and the effects of haemorrhage results in part from the fact that each evokes the same mechanism of compensation and in part from the deficiency of circulation which each produces. Points of contrast between shock and the effects of haemorrhage are so numerous that the assumed identity of these conditions is no longer tenable. In traumatized dogs Cullen *et al.* (1941) found that haemoconcentration was not a significant factor and that the earliest sign of shock was a marked reduction in the peripheral blood flow, there being an approximate correlation between the product of the change in blood pressure and the haemoglobin percentage with the circulation time (Olson *et al.*, 1941). Werle *et al.* (1942) indicate that a continuing state of post-haemorrhagic hypotension is not necessarily equivalent to shock, because (in dogs suffering from the effects of bleeding only) arterial pressures and pulse rates were restored to normal for many hours by reinfusion of the withdrawn blood even when such animals were on the verge of cardiac or respiratory failure and the viscera showed no pathological changes at necropsy, whereas the converse was found in dogs suffering from traumatic shock without blood loss. If, however, the intensity and duration of post-haemorrhagic hypotension were great enough, then "haemorrhagic shock" developed, marked by failure of transfusion to restore the circulation, and oedema, etc., of gut and lung.

Consideration of the above case histories shows that these casualties suffered mainly from post-haemorrhagic hypotension combined with a certain degree of shock, except Cases 8 and 10, in which the latter predominated. Case 9 illustrates the effect of continued hypotension leading to "haemorrhagic

shock." They show that, if shock is not too profound, (a) the heart is capable of dealing adequately with large volumes of infused fluid, and (b) the vascular bed is capable of retaining this added fluid for utilization by the circulation. It is evident that if the standard blood volume of the intact subject be taken as 6 l. the hypotension develops after the loss of 25% of the blood volume (average blood loss after wounding calculated from the formula given by Bushby *et al.*, 1940), and can be speedily and successfully combated by the rapid infusion of 33% of the initial blood volume. The subjects considered cannot have suffered from any great degree of traumatic shock affecting vascular "tone" or of anoxic depression of the myocardium, since the heart could successfully deal with 43% addition to the available fluid volume.

Summary and Conclusions

Details are given of 10 battle casualties suffering from shock due to trauma and blood loss, and the effect of rapid replacement of the estimated loss of fluid on the temperature, pulse, respirations, blood pressure, haemoglobin, and general condition.

Rates of infusion in the nature of 143 c.cm. a minute in no way embarrassed the cardiac mechanism.

Cases of toxæmia (peritonitis) and lung wounds developed pulmonary oedema after massive transfusion; cases of peripheral trauma and haemorrhage without sepsis did not.

The statement of Edwards *et al.* (1940) is not considered exact, while that of Keith (1919), though frequently correct, is misleading. Blood-pressure readings alone are not sufficient to estimate blood loss or to differentiate serious states of shock from temporary hypotension.

Reactions other than transient rise of temperature were few.

It is strongly recommended, therefore, that an estimate of blood volume lost be made in all battle casualties thought to need transfusion, from the history and the findings modified by experience, and that this be checked subsequently from haemoglobin readings taken before and after infusion of plasma, which must remain the mainstay of the infusion technique in the field unless refrigeration facilities increase greatly. The estimated fluid loss should be replaced at speed with the aid of pressure, thus ensuring adequate volume replacement and preventing simple post-haemorrhagic hypotension from developing into true shock.

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In a Chadwick Lecture entitled "Some Observations on the Management of Hospitals in Peace and War" given on Oct. 31, Mr. Somerville Hastings, F.R.C.S., said that no single hospital could provide economically and efficiently for every type of case. Hospitals must therefore be grouped under the direction of a central co-ordinating body. Nevertheless, local interest must be maintained by a committee of management for each individual hospital. The staff of a hospital must be able to make suggestions for the improvement of its administration; and medical, nursing, and lay staff committees were desirable. Each department of a hospital, general or special, should be organized on the clinical unit system, with a doctor of consultant status in charge. The superintendent of a general hospital should not be a skilled clinician, but a doctor with administrative experience. The medical staff of a hospital should be full-time officers who should live in or near by. They should have complete professional, intellectual, and political freedom and there should be abundant clerical assistance at their disposal. Change of hospital was desirable, at any rate till middle age. Short-listing for promotion should be undertaken mainly by doctors engaged in the same branch of practice. The presence of students added to the prestige of a hospital and improved both the status and the efficiency of the staff.