It is not difficult to conceive how bilharzia eggs can reach the spinal canal from an infection with *S. haematobium* or *S. mansoni*.

Batson (1940) and Franks (1953) have shown that there are communications with the common iliac and inferior vena cava from the vertebral venous plexus veins. They have shown that raising the intra-abdominal pressure will cause blood from the iliac veins to pass into this system, and that this is the probable route taken by secondaries to the cord in carcinoma of the prostate.

Coman and deLong (1951) showed experimentally that they could induce tumour growth in this situation by suitable injection of a rat tumour into the iliac vein with the vena cava compressed. One of these tumours actually grew in the spinal cord.

That adult schistosomes themselves may enter the spinal canal, presumably by this route, has been demonstrated by Raper (1948).

Cases described in the literature suggest either a localized lesion with cord compression or a rather diffuse lesion as in the case described.

The one might be thought to be due to a pair of adult schistosomes ovipositing in veins in close proximity to the spinal canal, and the other as due to a rather diffuse and irregular bombardment of the cord via the vertebral venous plexus, a state that would more easily arise in *S. haematobium* infections. In fact, in view of its situation it might give rise to this complication of cord involvement more often than *S. mansoni*. That it does not do so more frequently is perhaps a little surprising. Gelfand (1950), looking for eggs, found that only one out of 25 cords of bilharzia cases showed ova, whereas they were common in the brain of these cases.

From reports in the literature there is a distinct suggestion that *S. mansoni* tends to produce a localized granuloma whereas *S. haematobium* produces a more diffuse lesion.

Diagnosis during life is not easy; schistosomiasis is widespread in many areas, yet this complication appears to be a rarity. The only cases where diagnosis has been established during life are those operated on for a suspected spinal tumour. Obrador (1948), discussing the diagnosis of cerebral cysticercosis, has mentioned that the two most helpful findings were a low sugar in the C.S.F. and an increase of eosinophils in the C.S.F. Conceivably the same condition might obtain in schistosomiasis. An increase of cells was noted in the C.S.F. of this case, but eosinophils were not specifically looked for. It was also noted that the sugar content in one specimen was unaccountably diminished.

Clearly schistosomiasis must be borne in mind when considering obscure spinal-cord lesions in those who may have been exposed to a schistosome infection at some time.

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RAPID ESTIMATION OF FIBRINOGEN IN OBSTETRIC CASES

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Patients who have had a concealed accidental haemorrhage, a death *in utero*, amniotic fluid embolism, or premature separation of the placenta are prone to severe haemorrhage associated with a defect of blood coagulation (Weiner *et al.*, 1950; Reid *et al.*, 1953). This is thought to be due to a reduction in the fibrinogen level of the blood (Dieckmann, 1936), and while theories about the causation of the defect are various (Weiner *et al.*, 1950; Albrechtsen *et al.*, 1955; Ratnoff *et al.*, 1955), the response to fibrinogen therapy has now been proved by experience (Weiner *et al.*, 1950; Reid *et al.*, 1953; Barnett and Cussen, 1954; Scott, 1955).

The clinician faced with a patient in one of these categories wishes to know as quickly as possible whether she has a deficiency of fibrinogen or whether the haemorrhage has a purely obstetric origin. A simple coagulation-time will give some information, but does not indicate anything short of a complete absence of fibrinogen and does not really enable any quantitative control of treatment to be maintained. For the most satisfactory handling of such a case a rapid estimation of the fibrinogen level is required in order that the progress of the patient may be followed and the treatment planned to meet the patient's needs. In practice it is important to decide when it is necessary to give fibrinogen and at what point in labour or the puerperium it can be used with most advantage, since it should not be administered unless really required. Of the simple methods available a straighforward coagulation-time will not always reveal the true condition of these patients, and tests which use an excess of thrombin to clot samples of whole blood (Scott, 1955) will do no more than indicate the presence of a severe defect and give no help in deciding when to intervene in the less serious cases. It is, however, of use in circumstances where it is not possible to carry out other tests.

The methods at present available for estimating fibrinogen are as follows: (1) Kjeldahl, (2) turbidimetric estimation of fibrinogen after precipitation by ammonium or other salts, (3) colorimetric estimations of fibrinogen after coagulation by thrombin or calcium salts, (4) electrophoretic methods, and (5) methods based on the addition of thrombin to varying dilutions of plasma to form a fibrin clot—for example, Rosenberg's (1956) technique.

The first four methods, though variable in their accuracy, are chemically satisfactory, but take far too long for practical use in these types of cases. The precipitation methods reviewed by Podmore (1959) can give variable results, and are dependent on such extraneous factors as the correct amount of anticoagulant being used. Methods based on clot formation by thrombin with varying dilutions of plasma—for example, Rosenberg's technique—are quick and can be calibrated to give a useful and known range of accuracy.

Some technical skill is required to make the necessary range of dilutions, and suitable reagents and tubes have to be available, but these tests are quite practical for use in emergencies.

In an endeavour to meet the need for a fast and reasonably simple method, a technique has been developed in which the minimum of equipment and technical skill is required and which uses apparatus likely to be familiar to many. In addition the fibrinogen is converted to fibrin by a substantial excess of thrombin and hence the presence of antithrombins or substances of the heparin type do not interfere. Furthermore, the reading can be made within 10 minutes and thus fibrinolysins should not substantially affect the result. In principle, plasma is clotted by thrombin in a glass cell, for use in the M.R.C. grey wedge photometer, and the optical density measured on the scale. The fibrinogen level corresponding to this will then be read from a calibration curve.

Method

The details of the method are as follows:

Apparatus: M.R.C. grey wedge photometer; No. 2 yellow-green filter; two cells for photometer; graduated pipettes for saline, thrombin, and plasma.

Solutions: Saline, 0.85% sodium chloride; thrombin, 100 units per ml. in saline prepared fresh each day.

Plasma: Centrifuge blood, preferably 5 ml. (containing 2 mg. potassium oxalate per ml.) at 2,500 r.p.m. for 5 to 10 minutes.

Procedure.—The quantities used are as follows:

	Test	Control
Saline	1.5 ml.	1.7 ml.
Thrombin	0.2 ml.	—
Plasma	0.5 ml.	0.5 ml.

First the plasma is added to the control and mixed, and then to the test solution. This should *immediately* be inverted three times before coagulation occurs, and left for 20 minutes to obtain the maximum turbidity. If required, the test can be read after 10 minutes, when about 95% of the maximum turbidity will be attained. The actual reading is taken against the control in the photometer, and the amount of fibrinogen present per 100 ml. of plasma can then be calculated from the graph (see Fig. 2).

Results

The Table shows a comparison between the results obtained by the above method and the micro-Kjeldahl estimations on the same samples. In calculating the results the readings from the grey wedge photometer have been converted to fibrinogen levels by using the calibration chart (see Fig. 2).

The Table shows the fibrinogen levels and approximate maturity of a number of pregnant patients together with the levels from a small number of normal individuals. In addition, the results obtained with plasma in which the fibrinogen has been artificially lowered are included. Most of the samples tested were collected from pregnant patients from whom blood was being taken for routine tests. However, in order to extend the range below 200 mg./100 ml., plasma was prepared with an artificial low fibrinogen content. To do this, serum and plasma were obtained from volunteers and dilutions of plasma were made in serum from the same individual. In this way varying concentrations of fibrinogen were obtained from each sample. Wherever possible, duplicate tests were carried out by separating the plasma into two portions and precipitating the fibrinogen from each quite independently, estimations being carried out entirely separately on each portion of fibrin.

As can be seen from Fig. 1, our proposed technique gives a reasonable spread of values about the mean throughout the whole of the useful range, and in Fig. 2 a proposed calibration curve is shown for this method, effective only with this type of photometer. The total time required for completing the test is 30 minutes from receiving the specimen of blood, but it can be completed within 20 minutes or less, after separation of the plasma.

Results on Bloods from Pregnant Patients, Normal Adults, and Artificially Lowered Plasmas

Pregnancy (Weeks)	Bloods from Pregnant Patients			Normal Bloods			Artificially Lowered Plasmas		
	Grey Wedge		Kjeldahl mg./100 ml.	Grey Wedge		Kjeldahl mg./100 ml.	Grey Wedge		Kjeldahl mg./100 ml.
	Optical Density	mg./100 ml. from Fig. 2		Optical Density	mg./100 ml. from Fig. 2		Optical Density	mg./100 ml. from Fig. 2	
39/40	58	475	534	48 48	375 375	381 369	24 25	135 145	150 130
	59 52	485 415	441 420	45 43	345 325	388 375	18 17	75 65	55 39
	55 53	445 425	346 320	36 35	255 245	256 244	30	195	175
	60 56	495 455	563 507	39 38	285 275	234 227	25	145	135
	47	365	408	39 36	285 255	278 234	22	115	109
	49 49	385 385	384 384	42 40	315 295	328 278	30	195	168
	48 45	375 350	360 317	36 35	255 245	229 226	23	125	104
	55	445	607	45	345	364	21 21	105 105	103 112
	50 49	395 385	399 289	42	315	358	20	95	128
35/36	53 49	425 385	474 363				26 23	155 125	203 190
	55 55	445 445	450 350				18 21	75 105	101 134
	65 64	545 535	555 506				16 17	52 65	96 82
	51 49	405 385	405 392				20	95	108
	55 51	445 405	532 518				31 28	205 175	116 115
	65 65	545 545	490 479				23	125	67
33/34	52 51	415 405	437 354				17	65	74
	56 52	455 415	360 324						
	55	445	324						
	54 46	435 355	415 401						
	39 39	285 285	402 365						
	50 49	395 385	405 405						
	55 52	445 415	539 528						
30/33	52 50	415 395	408 398						
	61 59	505 485	427 392						
26/29	42	315	245						
	64 62	535 515	536 494						
20/25	47 46	365 355	316 294						
13/18	61	505	427						
	42 39	315 285	315 208						
8/12	47 42	365 315	317 255						
	49 48	385 375	368 343						

The only important disadvantage found with this method is that haemolysed blood gives abnormally high values and so is unsuitable for this test.

Discussion

It is of little practical importance whether a patient's fibrinogen level is 200, 250, or even 300 mg./100 ml., but it is of great importance to know when it is as low as 50 mg./100 ml., and particularly whether it is rising or falling at this point. With such a simple test it is possible—assuming that the patient's veins remain patent—to take estimations at hourly or two-hourly intervals until after delivery and so obtain a series of readings, comparisons between which give a much more reliable picture of her condition than any single observation.

The ready availability of a method of estimating fibrinogen has proved of great value in enabling results to be obtained in likely cases before a failure of blood coagulation has become apparent, and in such cases prophylactic treatment can be planned as necessary, and supplies of fibrinogen and blood of the correct group obtained well in advance of delivery.

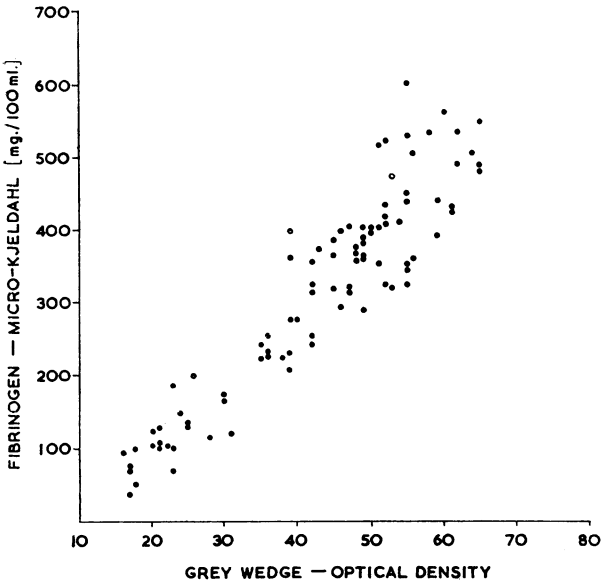

FIG. 1.—Relationship of fibrinogen estimated by micro-Kjeldahl and the optical density by the grey wedge photometer.

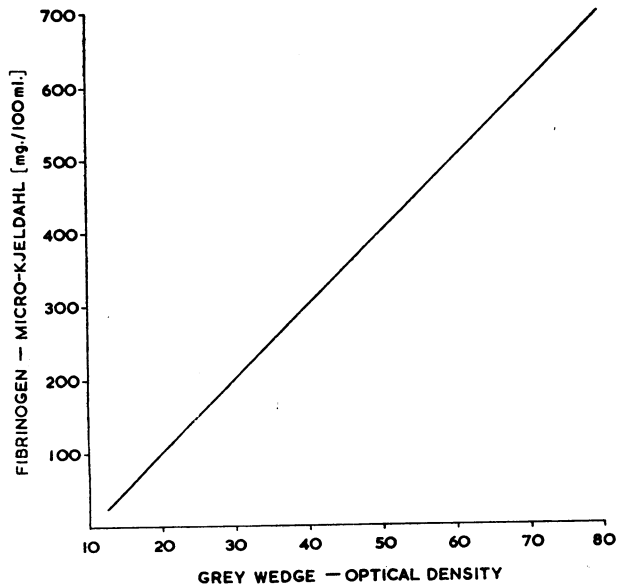

FIG. 2.—Proposed calibration chart for conversion of optical density measurement to mg./100 ml. of plasma fibrinogen.

In such a case as this the administration of fibrinogen can be held over until the patient is at or near delivery, provided that no actual haemorrhage occurs and that the fibrinogen level remains around 100 mg./100 ml. If it falls below 50 mg./100 ml. the administration of fibrinogen is probably wise. Even so, it is desirable to follow the progress of the fibrinogen level in order to see whether the infused fibrinogen is being destroyed or not.

Summary

The need for a rapid method of estimating fibrinogen in cases of hypofibrinogenaemia and the value of serial estimations are discussed.

A method of measuring directly the density of fibrin produced by adding thrombin to plasma is proposed and a calibration chart for the M.R.C. grey wedge photometer is given.

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Medical Memoranda

Two Unusual Complications of Umbilical Hernia in Childhood

It is now generally accepted that the condition of infantile umbilical hernia is a harmless one with a strong tendency to self-cure. Both incarceration and rupture of such herniae are extremely uncommon, and they rarely give rise to any symptoms. Though in no way affecting the accepted principles of management for this type of hernia, we feel that the following two cases, one of strangulation of omentum and the other of spontaneous rupture, are worth recording.

CASE 1

A girl of 7 years was noticed in infancy to have a small umbilical hernia. Early in her fourth year she was seen in this department when the hernia was small and easily reducible, and treatment was not thought to be necessary. She was seen again in her seventh year after several attacks of acute central abdominal pain. The hernia was still present, and would admit the tip of a little finger. It was felt that the attacks of pain were unrelated to her hernia.

Almost a year later, after a sharp bout of coughing, she complained suddenly of severe central abdominal pain. During the afternoon she lay on a sofa in continuous pain,