

THE RELATION OF THE BLOOD FIBRIN TO THE HÆMORRHAGIC DIATHESIS OF OBSTRUCTIVE JAUNDICE

BY ROBERT R. LINTON, M.D.

OF BOSTON, MASS.

FROM THE SURGICAL SERVICES OF THE MASSACHUSETTS GENERAL HOSPITAL

THE hæmorrhagic tendency in patients with obstructive jaundice has long been recognized. As yet there has been no adequate explanation of the cause of this predisposition to hæmorrhage. It is not known whether some factors necessary in the coagulation of the blood are deficient, or whether there is an increase in some of the anti-coagulants normally circulating in the blood.

For a number of years the blood calcium was thought to be deficient, or to exist in a form unavailable for the clotting of the blood. Recent investigations,^{1, 2} however, have thrown much doubt on this theory. A number of investigators have shown there is no deficiency, either qualitatively or quantitatively, in the blood calcium. Other theories of the cause of the bleeding tendency such as an accumulation of bile-salts or bile-pigments have also been disproven.^{3, 4, 22}

At the present time none of the methods in use to prevent or correct the hæmorrhagic tendency, by the administration of drugs, is grounded on sound scientific basis. The most effective means of control is the repeated transfusion of whole blood. In some cases even this fails and the patient dies from uncontrollable hæmorrhage. Whether it is the addition of normal platelets, or other elements necessary for coagulation, which controls the bleeding in some of the cases, is not known. The various methods, including the use of calcium chloride intravenously, have proven inadequate in a great many cases.² Attempts to improve the liver function by means of a high carbohydrate and fluid intake are of importance both pre-operatively and post-operatively, but if hæmorrhage has commenced these measures are of little immediate value.

The Blood Fibrin in Severe Liver Disease.—The blood fibrin is one of the important elements in the coagulation of the blood. The chief and perhaps sole source of it is the liver. In the hæmorrhagic diatheses associated with severe liver destruction, produced experimentally by phosphorus or chloroform poisoning, there is a marked diminution of the blood fibrin. This decrease is thought to explain the diminished coagulability of the blood in marked parenchymal liver damage. In obstructive jaundice of long standing there has been shown to be considerable parenchymal liver damage.^{11, 12} Because of these facts, I have investigated the blood fibrin in a group of patients with obstructive jaundice, to see if a diminution in this substance may play a rôle in the associated hæmorrhagic diathesis.

According to Melchior,¹⁹ Wunderlich, about seventy-five years ago, noted bleeding in cases of phosphorus poisoning, cholangitis, carcinoma of the liver parenchyma and in

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jaundice, and it is reported that he found a decrease of the fibrin in these cases. In 1894 Corin and Ansiaux,⁶ working with phosphorus poisoning, concluded that the incoagulability of the blood was due to a decrease in the fibrin. In 1900 Jacoby¹⁸ corroborated this work. Later in 1905 Doyon⁷ and his co-workers showed that there was a similar decrease of the fibrin and an associated incoagulability of the blood, in chloroform poisoning. They thought this reduction of the fibrin in both phosphorus and chloroform poisoning was due to a toxic action on the liver.

In 1911 Whipple and Hurwitz⁸ confirmed the work of Doyon on chloroform poisoning. Later in 1921 Foster and Whipple,⁹ continuing the work, also found a decrease of the fibrin following severe liver damage and associated with this, a marked incoagulability of the blood. They also noted that the fibrin returned to normal as hepatic repair occurred. Schultz *et al.*¹⁰ recently confirmed this hæmorrhagic diathesis in severe liver damage, which is apparently explainable by the diminished blood fibrin.

Normal Blood Fibrin.—The normal blood fibrin level varies considerably according to the figures reported in the literature. Foster¹⁴ states that variations of approximately 15 per cent. above or below the average are to be considered within normal limits. The normal fibrin values for humans are given in Table I. These four sets of figures seem to be the most reliable that have been reported in the literature. The average number of milligrams of fibrin per 100 cubic centimetres of blood and plasma, according to the above set of figures, vary respectively from 155 to 172 and from 280 to 338. The mean values are 166 milligrams of fibrin per 100 cubic centimetres of blood and 321 milligrams per 100 cubic centimetres of plasma.

TABLE I
Normal Fibrin Values (Human)

Investigator		Fibrin per 100 cc. Plasma	Fibrin per 100 cc. Blood
Gram, ¹³ 50 determinations	{ Maximum	370	200
	{ Minimum	205	115
	{ Average	280	155
Foster, ¹⁴ 42 determinations	{ Maximum	457	221
	{ Minimum	256	127
	{ Average	338	171
McLester, ¹⁵ 15 determinations	{ Maximum	385	...
	{ Minimum	272	...
	{ Average	333	...
Foster, and Whipple, ¹⁴ 4 determinations	{ Maximum	364	178
	{ Minimum	316	163
	{ Average	335	172

Blood Fibrin in Obstructive Jaundice.—Blood-fibrin values in obstructive jaundice have been reported by several investigators. These have been isolated determinations in the majority of instances.

Whipple, and Hurwitz⁸ in 1911 noted in a dog with complete obstruction of the common bile-duct there was a slight elevation of the blood fibrin at the end of two weeks. Gram¹³ in 1922 reported seven blood and plasma fibrin determinations in four cases of obstructive jaundice due to carcinoma of the pancreas and bile-ducts. All of

these figures are several times the normal value, but he did not mention the incidence of hæmorrhage. Foster¹⁴ in 1924 reported the blood- and plasma-fibrin values in two cases of obstructive jaundice. In both cases the values are above normal. McLester and co-workers¹⁰ reported in 1925 fibrin studies in liver disease but did not include cases of obstructive jaundice. Weltmann and Neumayer²¹ in 1925 reported from Germany the fibrin values in fifty-six patients with liver diseases. Twenty-seven of these showed increased values. They were chiefly cholelithiasis and neoplasm. Twelve others had normal values and the remaining seventeen had reduced determinations. The latter were chiefly diseases of the liver parenchyma. Baumann²⁰ in 1930 from Germany reported fibrin values well above normal in two cases of acute yellow atrophy, and two cases of carcinoma of the head of the pancreas with obstructive jaundice. The former bled to death post-operatively, one of the others bled post-operatively, and the fourth case developed hæmorrhages spontaneously. In addition to the above, several European investigators, including Wildegans,²² Murakami, and Yamaguchi,²³ Isaac-Krieger, and Hiege,²⁴ and Schultz, and Scheffer²⁵ reported fibrin values in patients and animals with obstructive jaundice, but their results are of questionable value, because the method they used is not a quantitative one. It was described by Wohlgemuth²⁶ in 1910.

Method of Fibrin Determination.—There are several methods by which the blood fibrin may be determined. Schultz *et al.*¹⁰ give a complete list of references. The most practical method is to change the fibrinogen to fibrin by causing the plasma to clot. This clot is readily handled and the amount of it may be determined either gravimetrically or by means of the Kjeldahl method. The determination of the fibrin by gravimetric means compares accurately with direct determination of the fibrinogen by precipitation with sodium sulfate,¹⁷ and also with other methods.⁵

The method I have found the most satisfactory is the gravimetric method originally described by Foster, and Whipple⁵ and later modified by Schultz *et al.*¹⁰ I have added another slight modification. Instead of a 2 per cent. solution of sodium oxalate as an anti-coagulant employed in the collection of the blood, I have used a dry-powdered anti-coagulant. The advantage of this is that in computing the fibrin values and reading the hæmatocrit values one does not have to take into consideration any correction because of dilution of the sample of blood, due to the anti-coagulant.

The method I used in detail is as follows: Five to seven cubic centimetres of blood are withdrawn from a vein by syringe and needle. The blood is immediately put in a small bottle containing approximately 14 milligrams of powdered potassium oxalate. A thorough mixing by shaking the bottle prevents coagulation. The plasma is separated from the red corpuscles by centrifugalization. This is done in a graduated tube, so that the hæmatocrit reading is obtained. Two cubic centimetres of the clear plasma are then drawn off with a pipette, and mixed in a 50 cubic centimetre centrifuge tube with 40 cubic centimetres of a clotting solution containing 0.8 per cent. sodium chloride and 0.125 per cent. calcium chloride.

After a period of two to three hours at room temperature or twelve hours in the ice box, the fibrin of the plasma forms a coagulum. This is freed from the side of the tube with a glass rod. It is then collected either by means of a fine glass rod by which the fluid may be expressed from the fibrin, or as Schultz *et al.*¹⁰ describe, by means of high-speed centrifugalization in which case the fibrin is compressed into a small white button. Some of the coagulums are so friable that the glass rod breaks them into many pieces. This makes the fibrin extremely difficult to collect by this means. In these

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cases I found centrifugalization is the best mode of collection. The tough coagulums are more easily collected with a glass rod.

The next step is to press the fibrin between filter paper to express the excess water. The small pellet of fibrin is then transferred to a porcelain crucible and dried for one to two hours in an oven at 110° C. After cooling in a desiccator the crucible and fibrin are weighed carefully. The fibrin is then burned by placing the crucible over a Bunsen burner for five minutes. The crucible and ash are again cooled in a desiccator and then weighed. The difference in weight represents the amount of fibrin in 2 cubic centimetres of plasma. From this figure the amount of fibrin per 100 cubic centimetres of plasma and blood are readily computed by the following formulæ:

$$\frac{\text{Milligrams fibrin in 2 cubic centimetres of plasma} \times 100}{2} =$$

Milligrams of fibrin per 100 cubic centimetres of plasma

and

$$\frac{\text{Milligrams fibrin in 2 cubic centimetres of plasma} \times \text{percentage of plasma}}{2} =$$

Milligrams of fibrin per 100 cubic centimetres of blood.

Clinical Observations.—Blood fibrin studies were carried out on a series of fifteen patients with obstructive jaundice. (Table II.) Six had carcinoma of the pancreas occluding the common bile-duct, two carcinoma of the gall-bladder involving the common bile-duct, three hepatitis and an associated cirrhosis, one cirrhosis of the liver, one metastatic carcinoma of the liver involving the common bile-duct, one carcinoma of the ampulla of Vater, and one case of cholelithiasis with obstructive jaundice. The patients' ages varied from thirty to sixty-three years. The minimum duration of the jaundice was one week and the maximum was ten weeks. Eight cases had jaundice of six or more weeks' standing. The minimum degree of jaundice measured by the quantitative van den Bergh test was 12 milligrams of bilirubin per 100 cubic centimetres of serum and the maximum was 31 milligrams, indicating in all cases a high degree of obstructive jaundice.

Thirteen of the fifteen cases were operated upon. In five cases, exploratory laparotomy was the only operative procedure. Seven of the patients developed post-operative bleeding. In three of these, hæmorrhage played a major rôle in the cause of death, and in the other four it was of less importance, but a contributing factor.

TABLE II

Fibrin Values in Obstructive Jaundice

CASE I.—Diagnosis.—Carcinoma of gall-bladder with obstructive jaundice. Female, fifty-seven years old. Duration of jaundice.—7 weeks. Degree of jaundice.—18.75. Blood fibrin.—219-490. Plasma fibrin.—300-700. No. of determinations.—2. No hæmorrhage.

CASE II.—Diagnosis.—Carcinoma of gall-bladder with obstructive jaundice. Female, fifty-four years old. Duration of jaundice.—2 weeks. Degree of jaundice.—13.5. Blood fibrin.—527-1046. Plasma fibrin.—800-1275. No. of determinations.—4. No hæmorrhage.

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CASE III.—Diagnosis.—Carcinoma of pancreas with obstructive jaundice. Female, forty-eight years old. Duration of jaundice.—6 weeks. Degree of jaundice.—30.0. Blood fibrin.—487-568. Plasma fibrin.—650-800. No. of determinations.—2. Hæmorrhage one plus.

CASE IV.—Diagnosis.—Carcinoma of pancreas with obstructive jaundice. Male, forty-nine years old. Duration of jaundice.—2 weeks. Degree of jaundice.—12.0. Blood fibrin.—357. Plasma fibrin.—700. No. of determinations.—1. No hæmorrhage.

CASE V.—Diagnosis.—Carcinoma of pancreas with obstructive jaundice. Male, thirty-eight years old. Duration of jaundice.—8 weeks. Degree of jaundice.—31.0. Blood fibrin.—487-536. Plasma fibrin.—650-800. No. of determinations.—3. Hæmorrhages four plus.

CASE VI.—Diagnosis.—Carcinoma of pancreas with obstructive jaundice. Male, forty-eight years old. Duration of jaundice.—6 months. Degree of jaundice.—15.0. Blood fibrin.—725. Plasma fibrin.—1150. No. of determinations.—1. No hæmorrhage.

CASE VII.—Diagnosis.—Carcinoma of pancreas with obstructive jaundice and cholelithiasis. Male, fifty-eight years old. Duration of jaundice.—10 weeks. Degree of jaundice.—12.0. Blood fibrin.—336. Plasma fibrin.—600. No. of determinations.—1. Hæmorrhage ten days later, just ante-mortem.

CASE VIII.—Diagnosis.—Carcinoma of pancreas with obstructive jaundice. Male, sixty-three years old. Duration of jaundice.—8 weeks. Degree of jaundice.—26.5. Blood fibrin.—420-612. Plasma fibrin.—600-800. No. of determinations.—4. Hæmorrhage four plus.

CASE IX.—Diagnosis.—Hepatitis with obstructive jaundice and cholelithiasis. Female, fifty years old. Duration of jaundice.—1 week. Degree of jaundice.—12.0. Blood fibrin.—310. Plasma fibrin.—500. No. of determinations.—1. No hæmorrhage.

CASE X.—Hepatitis with obstructive jaundice. Male, thirty years old. Duration of jaundice.—4 weeks. Degree of jaundice.—12.75. Blood fibrin.—341-558. Plasma fibrin.—550-900. No. of determinations.—5. Hæmorrhage three plus.

CASE XI.—Diagnosis.—Hepatitis with obstructive jaundice. Male, fifty-one years old. Duration of jaundice.—7 weeks. Degree of jaundice.—24.75. Blood fibrin.—330-612. Plasma fibrin.—550-900. No. of determinations.—10. Hæmorrhage two plus.

CASE XII.—Diagnosis.—Cirrhosis of liver with obstructive jaundice. Male, fifty-five years old. Duration of jaundice.—2 weeks. Degree of jaundice.—12.4. Blood fibrin.—270-384. Plasma fibrin.—450-600. No. of determinations.—3. No hæmorrhage.

CASE XIII.—Diagnosis.—Metastatic carcinoma of liver with obstructive jaundice. Male, sixty-two years old. Duration of jaundice.—8 weeks. Degree of jaundice.—26.0. Blood fibrin.—620. Plasma fibrin.—850. No. of determinations.—1. No hæmorrhage.

CASE XIV.—Diagnosis.—Cholelithiasis with obstructive jaundice. Female, forty-eight years old. Duration of jaundice.—1 week. Degree of jaundice.—20.8. Blood fibrin.—570-600. Plasma fibrin.—1000. No. of determinations.—2. No hæmorrhage.

CASE XV.—Diagnosis.—Carcinoma of the ampulla of Vater. Female, fifty-two years old. Duration of jaundice.—8 weeks. Degree of jaundice.—9.0. Blood fibrin.—324. Plasma fibrin.—600. No. of determinations.—1. Hæmorrhage four plus.

Blood fibrins are given in milligrams per 100 cubic centimetres of blood, and plasma fibrins in milligrams per 100 cubic centimetres of plasma. Normal values are, blood fibrin, 166 milligrams; plasma fibrin, 321 milligrams.

Repeated fibrin determinations were made both pre-operatively and post-operatively, when possible. A total of forty-one samples of blood were examined for blood and plasma fibrin values. In the entire group no diminution of the fibrin values was found, instead there was a marked increase in most cases. The minimum blood and plasma fibrins were 219 and 300 milligrams respectively. The maximum values were 1,046 milligrams and 1,275

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milligrams. The majority of the blood fibrins were in the neighborhood of 500 milligrams and the plasma fibrins lay between 600 and 800 milligrams. The mean values were 483 milligrams and 742 milligrams respectively. Compared with the mean normal values of 166 and 321 milligrams (*vide* Table I), the blood fibrin values in this group of cases with obstructive jaundice, are approximately three times as great, and the plasma fibrins are nearly two and one-half times the normal value.

Five of the cases which developed the typical hæmorrhagic diathesis of obstructive jaundice are of especial interest, as it was possible to study them

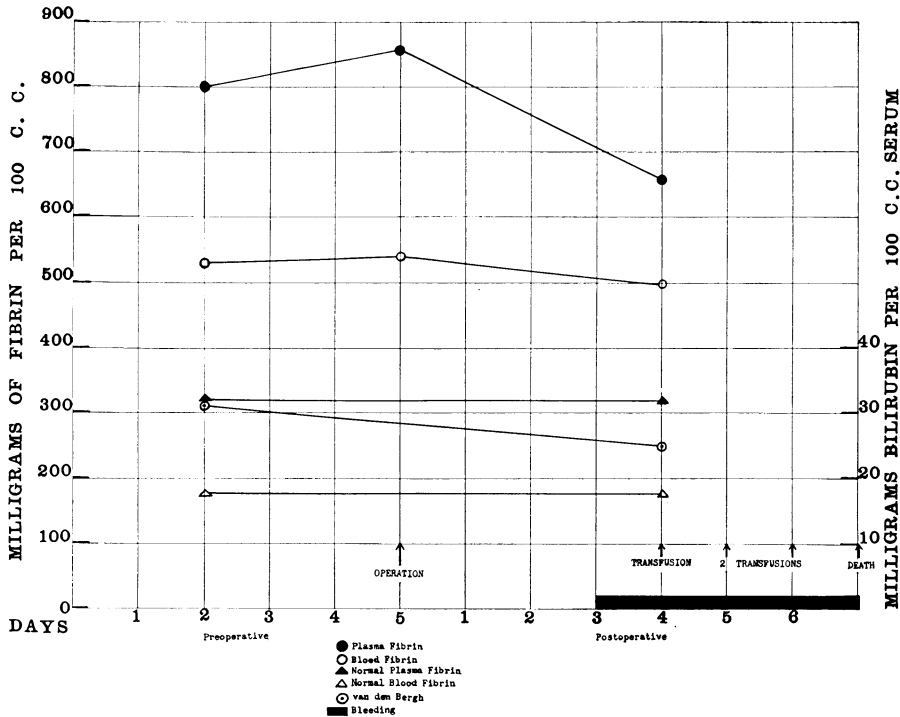


CHART I.—The blood and plasma levels in Case V.

before and during the bleeding stage. These were Cases III, V, VIII, X, and XI. (Table II.)

CASE REPORTS.—The following four cases with charts illustrate the high level of the blood fibrin which has been found in all these patients. I have chosen these four because they show the level before and during the actual bleeding.

(1) Case V, Chart I, shows the findings in a thirty-eight-year-old Irish workman, who entered the hospital complaining of jaundice of two months' duration without pain. He had a high degree of jaundice, 31 milligrams per 100 cubic centimetres of serum. The patient was placed on a high carbohydrate, low fat diet and was given three pre-operative injections of ten cubic centimetres of a 5 per cent. calcium chloride solution. At exploratory laparotomy under spinal anaesthesia a large distended gall-bladder was found with a small carcinoma of the pancreas occluding the common bile-duct. A cholecystogastrostomy was performed. Extreme care was taken to prevent hæmorrhage

at the suture line. A shoemaker's stitch was employed, using two needles and threads. This inner suture line was reinforced with a serosal stitch outside it. The abdomen was closed in layers without drainage. The patient stood the operation very well. Fluids were given post-operatively by clysis, vein and proctoclysis. Small amounts of water by mouth were started on the first day post-operative. On the third day post-operative he vomited 900 cubic centimetres of coffee-ground-like material. A nasal catheter was inserted and passed into the stomach. This was left in place as it continued to drain large amounts of bloody fluid. Within the next three days the patient received four whole blood transfusions, each one of 600 cubic centimetres. In spite of these, the bleeding continued, and death occurred on the seventh day following operation from uncontrollable hæmorrhage. Autopsy was not performed.

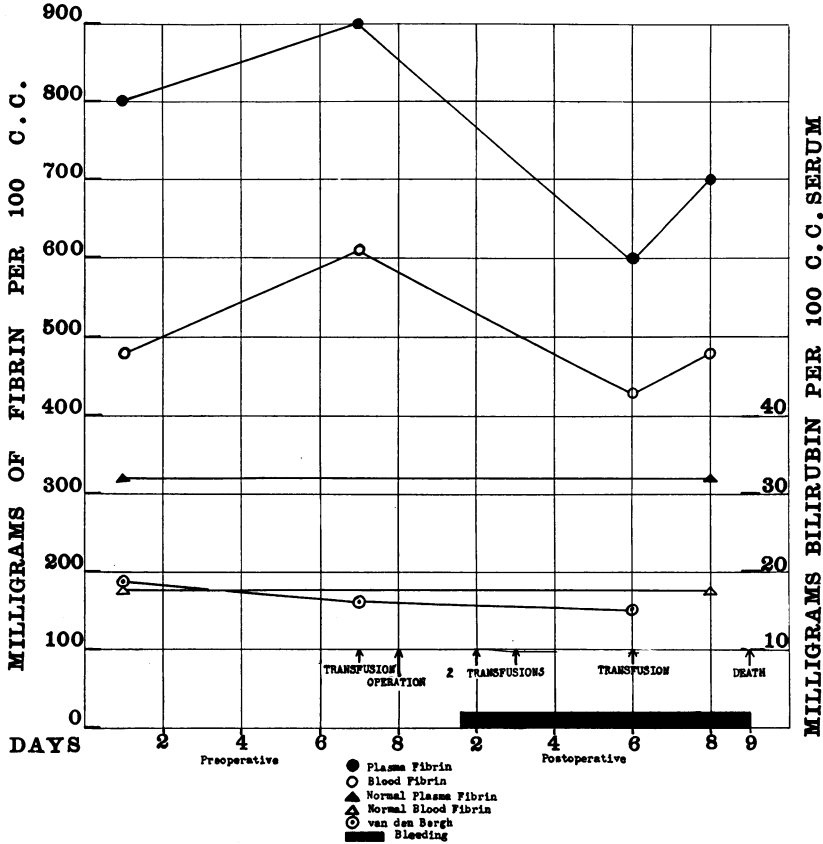


CHART II.—The blood and plasma levels in Case VIII.

Comment.—This patient died because of uncontrollable post-operative hæmorrhage and yet on three occasions, blood fibrin determinations showed no deficiency in the fibrin. The third estimation was done at the time bleeding was taking place, yet both the blood and plasma values are several times the normal values.

(2) Case VIII, Chart II shows the findings in a sixty-three-year-old man, who entered the hospital complaining of painless jaundice of eight weeks' duration, anorexia, nausea and general malaise. He had a high degree of jaundice with a serum bilirubin of 18.75 milligrams per 100 cubic centimetres of serum. A large distended gall-bladder and enlarged liver were palpable. After careful pre-operative preparation with fluids,

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glucose and blood transfusion, operation was performed. Under spinal anæsthesia a moderate-sized carcinoma of the head of the pancreas was found, which was obstructing the common bile-duct. The gall-bladder was filled with white bile. A cholecystogastrostomy was performed using three layers of chromic O catgut. The abdomen was closed in layers without drainage. Small amounts of water were given beginning the first day post-operative. The fluid intake was maintained by a continuous intravenous drip of 5 per cent. glucose solution in normal saline.

On the second day post-operative the patient vomited a little dark red bloody fluid and stomach lavage yielded 1,000 cubic centimetres of the same material. A nasal

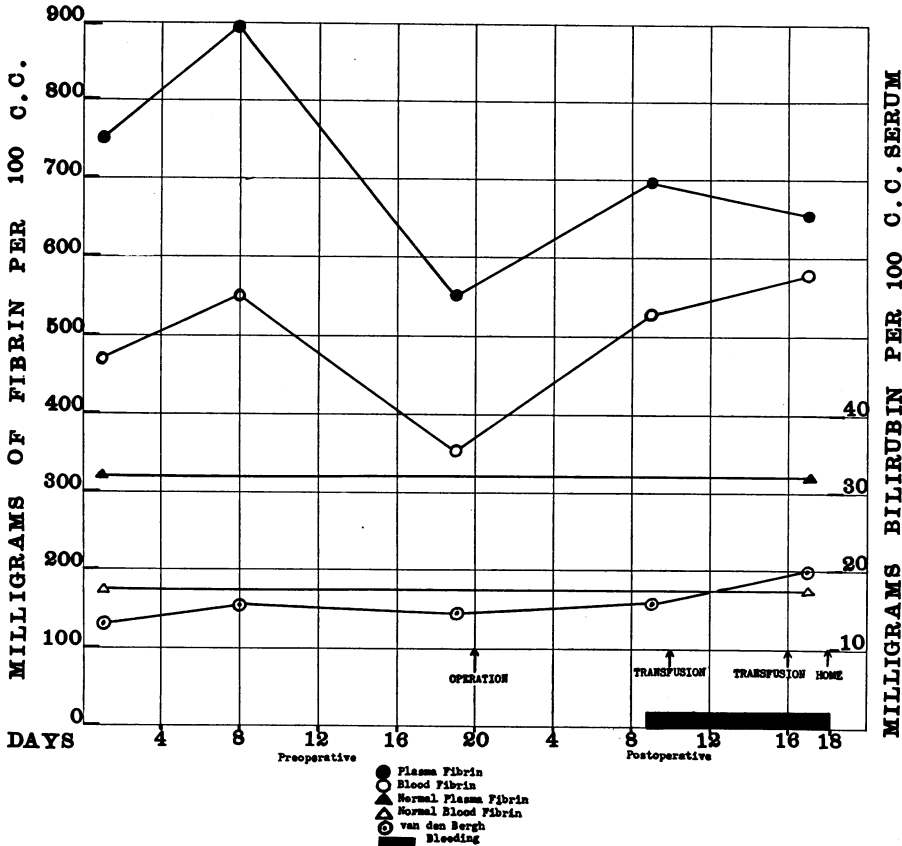


CHART III.—The blood and plasma levels in Case X.

catheter was passed into the stomach to drain off the fluid as it accumulated. Transfusions were given on the second, third, and sixth days post-operatively. The first two seemed to check the hæmorrhage temporarily, but the patient died on the ninth day post-operative from hæmorrhage and liver insufficiency. Bile was never demonstrated in the stomach contents. Autopsy confirmed the diagnosis, and in addition to the intra-biliary and gastro-intestinal hæmorrhage, there was considerable hæmorrhage around the cholecystogastrostomy with oozing into the peritoneal cavity.

Comment.—Blood and plasma fibrin determinations were done on four occasions, as the chart indicates. All of these are well above the normal value, even at the time hæmorrhage was taking place, thus showing that the hæmorrhage was not due to a lack of blood fibrin in this case.

(3) Case X, Chart III, shows the findings in a man of thirty years who entered the hospital because of painless, increasing jaundice of four weeks' duration. The serum bilirubin, according to the quantitative van den Bergh test, remained in the neighborhood of 13.0 milligrams. Stool examination on frequent occasions showed no bile. As a definite diagnosis could not be made, and because of persistent complete biliary obstruction, operation was advised. Exploratory laparotomy was performed under spinal anaesthesia three weeks after admission. No obstruction of the common bile-duct was found. A piece of liver was removed for biopsy which showed early biliary cirrhosis, thus accounting for the jaundice and clay-colored stools. Following

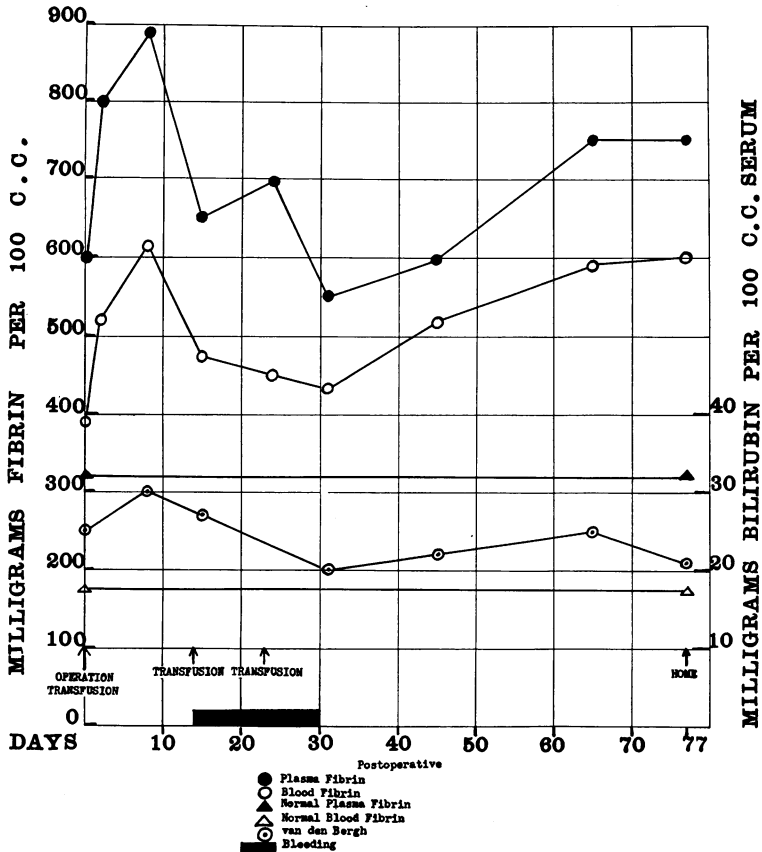


CHART IV.—The blood and plasma levels in Case XI.

the operation, the patient made a very slow recovery. The jaundice deepened considerably. On the ninth day post-operative, hæmorrhage from the wound was first noted. This became so alarming that two transfusions were given with partial control of the bleeding. The patient left the hospital the nineteenth day following operation, still bleeding from his wound. He died not long after leaving the hospital from hepatic insufficiency and cirrhosis of the liver.

Comment.—The obstruction of the biliary system in this case was not in the common bile-duct, but in the small biliary passages. The fibrin values, however, show much the same elevated level that the other cases of obstructive jaundice have shown. There was no diminution of them at the time of the post-operative bleeding.

(4) Case XI, Chart IV, shows the findings in a man of sixty-two years who

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entered the hospital complaining of painless, increasing jaundice of seven weeks' duration. His stools were clay-colored and were bile negative. The jaundice was of severe intensity as the serum bilirubin was 25 milligrams according to the quantitative van den Bergh test. Exploratory laparotomy was done under ether anæsthesia. No obstruction of the common bile-duct was found. The liver was large and showed a moderate degree of cirrhosis. The patient's convalescence was uneventful until about the fourteenth day, when bleeding was noted from his wound. This was controlled by two transfusions of whole blood, but not until it had lasted about two weeks. The patient was kept in the hospital in all about eleven weeks. His jaundice persisted. Continuous intravenous administrations of 5 per cent. glucose in normal saline was used, which I feel prolonged his life. He had no more actual bleeding, although he developed a number of areas of ecchymosis on his right arm. These were noted about fifty-three days following operation, and remained about a week. These, along with a very rapid sedimentation rate, still indicated a definite hæmorrhagic diathesis. He was eventually discharged from the hospital and died about six months later from cirrhosis of the liver with complete biliary obstruction.

Comment.—This case is similar to the preceding one. On all occasions the fibrin was found to be greatly elevated. The highest point was reached immediately post-operatively, but it was still markedly elevated during the bleeding stage and also when he developed the ecchymotic areas on his arm. At no time in his long stay in the hospital was there any evidence of a fibrin deficiency.

Discussion.—The hæmorrhagic diathesis of obstructive jaundice has not as yet been satisfactorily explained. In studying the possible causes of this serious complication, it seemed possible that a lack of fibrin in the blood might be an important factor, since in severe liver destruction there exists a marked diminution of the blood fibrin and an associated hæmorrhagic diathesis. Accordingly, blood fibrin studies were carried out on a series of fifteen patients with obstructive jaundice. These cases were selected because they all had a high degree of obstructive jaundice. Seven of this group, or 46.7 per cent., developed post-operative hæmorrhage. In three of these, or 20 per cent. of the entire group, hæmorrhage played a major rôle in the cause of death.

Repeated fibrin determinations were made according to the modification of the Foster and Whipple method described by Schultz, *et al.*¹⁰ Forty-one determinations were made in this series of cases. The blood fibrins varied from 219 to 1,046 milligrams per 100 cubic centimetres of blood and the plasma fibrins from 300 to 1,275 milligrams per 100 cubic centimetres of plasma. The mean blood and plasma fibrin values were respectively 483 milligrams per 100 cubic centimetres of blood and 742 milligrams per 100 cubic centimetres of plasma. In Case II on one occasion the blood fibrin was 1,046 milligrams. This high value was probably due to the fact that the patient had a diffuse broncho-pneumonia at the time the estimation was made. No case showed a fibrin value below normal. Compared to the mean normal fibrin values the mean blood and plasma fibrin values in this group of cases are respectively three, and two and one-half times as great.

Fibrin determinations were made pre-operatively and post-operatively. Immediately following operation there was a transient rise in the fibrin level in a few of the cases. This temporary rise was probably due to operative

wounds and low-grade pulmonary infections, as both these conditions have been shown experimentally in dogs to increase the fibrin level.¹⁰ In the majority of cases the fibrin level remained elevated. There was no noticeable diminution of it, even up to the time of the patient's death.

Of especial interest were the seven cases which developed post-operative bleeding. In five of these, determinations were made before and during the actual bleeding. Comparison of the fibrin levels before and during the bleeding, (see Table III) show that there was a slight decrease of the latter in four of these cases. In the fifth case the average fibrin value was higher during the bleeding. After the hæmorrhage stopped in this case the fibrin level dropped even lower than before its occurrence. These variations before, during, and after hæmorrhage are probably of little significance. The important fact, however, is that during the bleeding stage there was no marked decrease in the fibrin level, and that in all cases the amount of fibrin was two to three times the normal value.

TABLE III

Fibrin Values in Cases with Bleeding

Case	Before Hæmorrhage		During Hæmorrhage		After Hæmorrhage	
	Blood Fibrin	Plasma Fibrin	Blood Fibrin	Plasma Fibrin	Blood Fibrin	Plasma Fibrin
3	568	800	487	650	—	—
5	531	825	487	650	—	—
8	546	850	450	650	—	—
10	457	733	447	675	—	—
11	384	600	461	675	375	575

Blood fibrins are given in milligrams per 100 cubic centimetres of blood, and plasma fibrins in milligrams per 100 cubic centimetres of plasma. Normal values are, blood fibrin, 166 milligrams; plasma fibrin, 321 milligrams.

CONCLUSIONS

(1) Fifteen patients with obstructive jaundice were found to have blood and plasma fibrin levels several times the normal value.

(2) In six patients who developed post-operative bleeding the fibrin levels were several times the normal values even at the time of actual bleeding.

(3) In obstructive jaundice, there is apparently no deficiency in the blood fibrin.

(4) The hæmorrhagic diathesis of obstructive jaundice is not explainable by a quantitative deficiency of the blood or plasma fibrin.

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