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SPLENECTOMY IN PURPURA HEMORRHAGICA

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Purpura hemorrhagica or thrombocytopenic purpura is still a medical and surgical problem, although its existence was first noted more than 150 years ago. Despite much work and attention directed towards a solution of its etiology and pathology, the answer is not yet. An attempt is here made to marshall all the information that is available in the literature and to present a critical analysis of this data which analysis gives the numerous theories and a brief description of the work done, in demonstrating the possible etiological factors of this strange disease. The true symptomatology is discussed and a real differential diagnosis urged as an aid in successful treatment. All the available reported cases and five personal cases are presented, while a comparative analysis is made in an attempt to show the value of splenectomy in both the acute and chronic forms and also to demonstrate that the mortality has been appreciably reduced in the last four years, chiefly by reason of proper pre-operative and post-operative transfusions flanking a well-executed splenectomy.

Purpura hemorrhagica was first described by Werlhof,[18] in 1775. Knowledge concerning the nature of the disease developed gradually, until even today there is no complete agreement as to the etiological factors concerned nor as to the mechanism by which these factors act. Denys,[25] in 1887, first observed that the blood-platelets were missing in a case of purpura. Nine years later (1896), Hayem[58] showed that in purpura there was a failure of clot retractility. Duke,[29] in 1910, demonstrated that a thrombocytopenia and fibrinogen lack have very definite effects on bleeding time. He pointed out that the reduction of platelets in purpura hemorrhagica is associated with an increased bleeding time, but not with any marked variation in the coagulation time. Hess[60] showed conclusively that there was a marked weakening of the capillary vessels in purpura hemorrhagica as evidenced by the petechial and even large subcutaneous hæmorrhages which developed distal to a tourniquet applied to the upper arm tight enough to obstruct the venous flow.

These findings stimulated an investigation of blood-platelets, especially

concerning their function in maintaining a normal bleeding time, and as to the reason for their decrease in purpura hemorrhagica. It is now fairly well accepted by all workers in hematology that blood-platelets take their origin from the megakaryocytes of the bone-marrow. These cells are also found in the spleen in disease and in embryonic life, [84, 87] one of the evidences of close relationships between the units of the hemopoietic system.

The normal function of blood-platelets has been investigated both experimentally and clinically. Janeway, Richardson and Park,[67] in animal experiments, showed that an extract of platelets has a vasoconstrictor action, not found in an extract of any of the other formed elements of the blood nor in platelet free plasma. Hirose[61] showed that there was a direct proportion between the platelet count and the vasoconstrictor effect of defibrinated blood when brought into direct contact with the surviving carotid of an ox. Brill and Rosenthal[12] presented evidence to show that capillary hæmorrhage is normally stopped by the production of small platelet thrombi, and by the contraction of the vessels. The function of the platelets in the production of a retractile clot has been explained by Glanzmann.[47] Finally, there is evidence[12, 60] to show that the platelets produce a thromboplastic substance which has a function in the production of a clot.

The cause of the reduction of platelets in purpura hemorrhagica has been the subject of much controversial reasoning and of considerable experimentation. Frank[41] believed that there was a decreased platelet formation, an aplasia or decreased production of megakaryocytes in the bone-marrow caused by a myelotoxin coming from the spleen. He therefore called the disease essential thrombopenia.

Brill and Rosenthal state there is no diminution in the megakaryocytes in the bone-marrow in purpura hemorrhagica but they believe that the fragmentation of the pseudopods does not take place properly because in this disease the platelets are large and irregular and granular in appearance. (This change in the appearance of the platelets in purpura hemorrhagica was noted also by Rockwood and Sheard[121] in a photomicrographical study.) Brill, *et al.*, believed that the spleen is responsible not only for the alteration in the nature and properties of platelets in purpura hemorrhagica but also that it is the site of the destruction of the defective bodies. Krumbhaar[84] considers it probable that the spleen exerts "some regulatory influence on the megakaryocytes of the bone-marrow, the site of platelet formation." Mills[101] is not sure that the spleen is primarily responsible for the alteration of platelets, but suggests that destruction of altered platelets is one of the normal functions of the spleen.

Kaznelson[72, 73, 74, 75] outlined his opposition to Frank's decreased platelet *production* theory somewhat as follows: (1) If there were an inhibition of megakaryocyte production there should also be an alteration in other blood-cells formed by bone-marrow. (2) If there were a bone-marrow lesion, how could splenectomy effect an almost immediate cure? (3) The large size of the platelets found in purpura hemorrhagica indicates a stimulation of bone-marrow. He believes that the enlargement of the spleen often found in purpura suggests that that organ may be the site of the platelet destruction. For this reason he named the disease thrombocytolytic purpura and he suggested splenectomy as a means of treatment.

Experimentally, many investigations have shown that the injection of antiplatelet serum and anti-spleen serum decreases the platelets in the circulating blood.[6, 88] Various toxic and irritating substances when injected into the blood-stream also lower the platelet count.[30] Most authors now agree that the decrease in platelet content of the blood cannot alone account for the symptoms of hæmorrhage produced in purpura hemorrhagica. The belief is general that there is also a lesion of the capillaries,[6, 12, 18, 106, 119] and that in purpura the entire reticulo-endothelial system is at fault.

Because the spleen is thought to be the organ in which the destruction of the defective platelets takes place, Kaznelson,[72] in 1916, first suggested splenectomy as a means of

treating these patients. He noted an almost immediate cessation of bleeding and a rapid and marked increase in the number of blood-platelets after extirpation of the spleen. This observation has been confirmed many times since Kaznelson's first case, both experimentally,[6, 84, 129] and by numerous surgeons who have performed splenectomies for purpura hemorrhagica. Bedson[6] has shown in guinea-pigs that for three or four weeks after splenectomy while the platelet count is still high, antiplatelet serum has no effect in dosages sufficient to cause fatal purpura in normal control animals. Both experimental and clinical observers have noted a gradual fall after the immediate rise in the number of platelets after splenectomy and during the fall Bedson found his animals normally susceptible to antiplatelet serum.

The question has been raised as to whether the removal of the spleen *per se* is the effective agent in causing the increase in platelets after splenectomy. Holloway and Blackford,[64] in studying the platelet counts of the splenic artery and the splenic or peripheral veins, failed to bear out the platelet-destroying function of the spleen. Much of the experimental work seems to show that although splenectomy does produce a rapid rise in blood-platelets, other operations of equal magnitude produce similar results. Bachman and Hultgren,[3] Liles,[98] and Steiner and Gunn,[129] have demonstrated these facts in rabbits and they conclude that "the degree of rise in the platelet count depends upon the amount of trauma sustained by the tissues."

Dawbarn, Erlam and Evans[22] found a rise in the platelet count after operation, fractures and child-birth, beginning on the sixth day and reaching a maximum on the tenth. The platelets reached the normal number again in about three weeks. They believe that the common factor is injury to tissue with absorption of the products of protein disintegration. Our own experience has been that there is usually an immediate fall in the platelet count after an operation other than splenectomy. A rather marked rise occurs after about the sixth post-operative day which is maintained for a week or ten days or even longer. Von Goidsenhoven,[141] in reporting twelve cases of purpura hemorrhagica treated by ligation of the splenic artery, gives platelet counts before and after operation which also show a delayed rise in most cases. It would seem that other operations than splenectomy at least do not produce the immediate marked rise usually noted after removal of the spleen in patients.

It might be expected that by extirpation of the spleen, the surgeon was removing a pathological organ. Gregory[54] commonly finds a perisplenitis at operation and suggests that there is a primary infective lesion of the spleen. Leriche and Horrenberger[91] assert that the splenic picture is one of infectious splenomegaly without specific characteristics. Kaznelson[72] cites splenomegaly as evidence pointing to disease of the spleen in purpura hemorrhagica. On the other hand, MacCarty[96] has studied twenty spleens removed surgically because of purpura hemorrhagica. He says he has "not been able to distinguish this type of spleen from any normal spleen." The numerous reports from the literature fail to show any constant or characteristic histological changes in the spleen in purpura. That splenomegaly is not a characteristic finding is shown by McLean, *et al.*,[99] and by Stewart.[131] McLean, Kreidel and Caffey were able to palpate the spleen in only five of their twenty-one children with purpura hemorrhagica. Stewart, in reviewing thirty-five cases reported, noted fifteen with enlarged or palpable spleens and eleven with non-palpable or normal spleens.

From the foregoing it must be concluded that although many operators have repeated the brilliant results obtained by Kaznelson in his cases of purpura hemorrhagica with splenectomy there is still no definite evidence that the spleen is the organ at fault in this disease. Clinical experience bears out the various experimental investigations to point toward a dysfunction of the whole hemopoietic system.

In spite of the fact that the spleen cannot be definitely incriminated as

the seat of the disease in purpura hemorrhagica, the good results which have followed its removal have led many surgeons to accept this method of treatment. There appears to be an almost universal agreement that splenectomy is indicated if the diagnosis is definitely established, and if the case is one of the chronic recurring type.

The diagnosis is made on the following points: (1) "Spontaneous extravasation of blood into or under the skin and mucous membranes of the body."[117] (2) Diminished platelet count. (3) Prolonged bleeding time. (4) Approximately normal coagulation time. (5) Absence of clot retraction. (6) The appearance of petechia in the skin distal to a tourniquet blocking the venous but not the arterial flow. (7) Secondary anæmia without constant changes in the red blood-cells. (8) No constant variation in the white blood-cells, but usually an increase rather than a decrease.

Hitzrot[62] points out that the differential diagnosis must be made from hemophilia and anaphylactic purpura. The diagnosis from hemophilia may be made on the basis of the non-traumatic origin of the bleeding, the lack of a familial history, the normal clotting time, the prolonged bleeding time, and the decrease in platelets. The anaphylactic type of purpura is usually associated with fever. It is preceded by premonitory symptoms and does not show the prolonged bleeding time or absence of clot retraction associated with purpura hemorrhagica.

In addition, the diagnosis must be made between purpura hemorrhagica and two other hemorrhagic diseases, acute aplastic anæmia and acute leukæmia. In acute aplastic anæmia with hæmorrhage, there is a marked diminution of all the former elements of the blood. There is an absence of reticulated red cells and usually a decided leukopenia whereas in purpura hemorrhagica a moderate leucocytosis is the rule. The acute leukæmia with a normal white blood count is perhaps the hardest differential diagnosis to make. The chief diagnostic point appears to be the relative marked increase of the young white cells in the blood in leukæmia. Several reports in the literature describe cases in which splenectomy was performed for purpura hemorrhagica in which there was later developed the typical picture of acute leukæmia.

With these diagnostic criteria in mind it may be well to consider the second point in the indications for splenectomy, *viz.:* the chronicity of the case. Whipple[136] classes as chronic those cases of purpura hemorrhagica having repeated attacks of petechia, purpuric areas, bleeding from the gums and menorrhagia in women. The bleeding is not usually very profuse and is not into the alimentary canal or into the parenchyma of organs. He is of the opinion that in these cases the major portion of the disturbance in the reticulo-endothelial system is in the spleen because splenectomy produces a cure. Splenectomy is therefore advised in the chronic case. In this opinion he is supported by Spence,[128] Fitz Hugh,[38] Jones,[71] and many others. Williamson[138] limits his indications for splenectomy to his chronic cases in which the severity of the disease interferes with the normal life of the patient, making the patient a chronic invalid, or to those cases in which the severity and frequency of the hæmorrhages endanger the life of the patient.

The so-called acute purpura hemorrhagica is not so well defined in the literature. Some writers denote by the acute type the patient who suddenly begins to bleed without any previous history of hæmorrhage. Williamson[138] believes splenectomy is contra-indicated in the first attack, both on account of the uncertainty of the diagnosis and because of the unfavorable results.

Other authors such as Whipple[136] define the acute type as purpura hemorrhagica, occurring without any previous history of hæmorrhage, in which there is "sudden, severe, uncontrollable oozing of blood from mucous membranes and into the subcutaneous tissues and the internal organs." Hematemesis, hematuria, melæna and diffuse menor-

rhagia are characteristic symptoms. Whipple believes that such cases should be tided over by transfusions until the bleeding has stopped; and when built up, splenectomy to prevent recurrence. Still other writers designate those cases as acute in which there is uncontrollable severe hæmorrhage without reference to the number of previous attacks.

The opinions with regard to splenectomy in the so-called acute stage of the disease are varied. Fitz Hugh[38] and Jones[71] give the clinician's view in expressing the opinion that splenectomy has seemed to only hasten the fatal outcome in the acute fulminating cases. Whipple[136] and Spence[128] on the basis of their case analyses believe splenectomy is definitely contra-indicated in these cases. Giffin,[46] Reuben and Claman,[119] Rankin and Anderson,[117] Cowen,[19] Kerlin,[78] and Litchfield[86] all conclude that the acuteness of the hæmorrhage is not a safe guide as to whether splenectomy is indicated. These writers recognize that the results of splenectomy are much better in the chronic recurring type of purpura hemorrhagica with the hypertrophied spleen, but they hold to the view that even in the face of acute hæmorrhage, splenectomy should be performed if repeated transfusions fail to arrest bleeding, notwithstanding the fact that an occasional fatality may result. Maingot[105] is even more outspoken. He believes that splenectomy is the correct treatment for all cases of essential thrombopenic purpura hemorrhagica whether of the acute or of the chronic relapsing types. He maintains "that it is more urgently indicated for the acute types because medical treatment, blood transfusions, *etc.*, have no effect in arresting or even in ameliorating the factors which determine the fatal outcome."

A study of a group of cases of purpura hemorrhagica and of the literature on the subject leads to a view that the disease is one whose chief danger is from hæmorrhage, the exact etiological mechanism of which is not known. The disease tends to a spontaneous cure and recurrence as is characteristic of many of the blood dyscrasias. The therapeutic indications would appear to be, first, control of the hæmorrhage, and second, attempts to remove the etiological factors.

It would appear, therefore, that the treatment of hemorrhagica purpura cannot be divided into that for the acute type and that for the chronic type. The more logical consideration of the therapy would seem to be to employ first the most conservative method of treatment which removes the danger of immediate severe or recurrent hæmorrhage.

There can be no doubt that repeated transfusions may be effective in stopping the hæmorrhage and in producing a remission, often without subsequent recurrence, in many cases of purpura hemorrhagica. Larrabee,[90] Jones,[69] Krasso,[82] Engel,[33] and Moffatt[103] report proven cases which support this view. McLean, *et al.*,[90] have recently reported eight patients, all children, treated by transfusion. Of these five acute and three chronic cases, there were no deaths, five were symptom free, four to fourteen months, and three were still under treatment.

Larrabee believes that a transfusion of 500 to 600 cubic centimetres of unmodified blood raises the platelet count 20,000. He thinks the effect is approximately one week in duration, the life of the platelets in the blood-stream. Although this may be a useful measure in many of the less severe cases, transfusion alone usually does not prove sufficient in most of the patients with extensive hæmorrhage. Other methods of controlling hæmorrhages in purpura should be mentioned in this connection. Many of them have proved successful in an occasional case but their very multitude suggests that they have not been universally effective. Calcium administration or an elevation of the blood calcium by parathormone is recommended by some authors.[71] Dixon[27] reports four cases treated by intramuscular injections of twenty to thirty cubic centimetres of autogenous blood. Liver extract or a liver diet has been used with success by a few authors.[71, 66] Pancoast, Pendergrass and Fitz Hugh[109] have reviewed the literature and reported their results with the Röntgen treatment of purpura. Ultra-violet radiation has been shown to effect an increase in the platelet count experimentally,[130] and this finding has been used clinically by Giffin,[44] Jones,[71] McLean, *et al.*,[90] and many others.

A diet high in Vitamins B and C has been employed.[44, 71] Thromboplastin injections have been given by many in the therapy of purpura.[71] Antivenin injections have proved advantageous in other hands. The reports are increasing of the treatment of purpura with various forms of non-specific protein shock. Horse serum, milk, coagulen, peptone and even salvarsan have been given intramuscularly or intravenously with some reports of successful cases.[39, 50, 108, 45] None of these methods appears to produce the rapid control of bleeding necessary in the patient with extensive hæmorrhage. The most effective method of producing an immediate or rapid hemostasis appears to be the removal of the spleen. Whether an etiological factor in the causation of purpura is thereby removed, or whether the tissue trauma incidental to the operation is the effective factor in raising the blood-platelets and in stopping the hæmorrhage, the fact remains that no other procedure gives such striking results. Our own experience has been similar to that of most other operators, that the previous uncontrollable bleeding often stops almost entirely within the first twenty-four to forty-eight hours after operation, coincidental with a sharp rise in the platelet count.

Uncontrollable bleeding, then, whether sudden and severe or recurrent, appears to be the indication for splenectomy in purpura hemorrhagica.

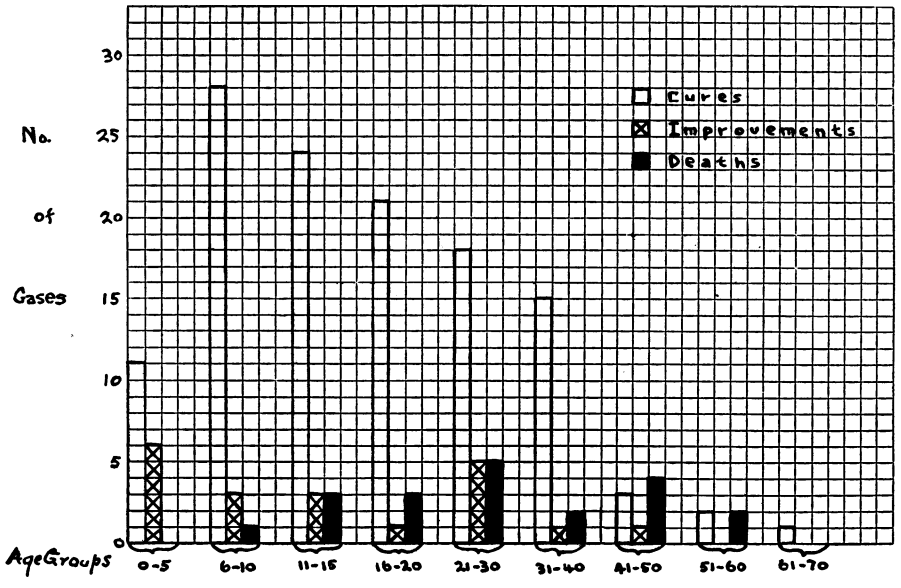
When should the operation be performed? The splenectomy should be performed before the patient has bled to such an extent as to be a poor operative risk, or after the patient has been prepared for operation by adequate blood transfusions. In some cases the hæmorrhage is so marked that a decision for operation must be made without delay. Anschütz[2] reports a case in which the hæmoglobin and red cells dropped from 85 per cent. and 4,100,000 to 45 per cent. and 2,460,000 in two hours. Immediate operation and transfusion saved the patient. In other instances less rapid but continuous bleeding may so deplete the patient as to make him a poor operative risk. In such cases repeated transfusions should be given until the hæmoglobin is returned to at least 50 per cent. (Marsh[97] points out that in six of the early fatal cases of splenectomy in "acute" purpura hemorrhagica the hæmoglobin and blood count were low, and that in all of the successful cases up to 1930 transfusions were given before operation.)

When the patient has been properly prepared, splenectomy may usually be performed without the danger of death from post-operative shock, the probable cause of the fatal outcome in many of the early cases.

The influence of the age of the patient at the time splenectomy is performed is frequently mentioned in the literature. Stewart,[131] Anschütz,[2] and Washburn[135] agree that the results are more satisfactory in children than in adults, and Washburn suggests further that the prognosis after splenectomy is probably more favorable if the spleen is removed early in the course of the disease. These statements are in agreement with Gross's[55] findings that the spleen is most active in the young and least active in the old. It would seem that early splenectomy or splenectomy in the early years might be expected to give the best results if the spleen plays a part in the disease. (See chart.)

The second indication in the treatment of purpura hemorrhagica would appear to be to remove the etiological factors. This is truly a real problem at this time when there is no definite knowledge concerning the cause of the

disease. However, it has been shown experimentally that purpura-like states, with marked reduction of the blood platelets, may be induced by the injection of diphtheria or other toxins.[30] Considerable literature is developing concerning the occurrence of purpura hemorrhagica after the injections of arsenicals in the treatment of syphilis.[94, 68, 23, 134, 9, 11] Whipple[136] showed that in twelve of twenty-one children with purpura definite infections preceded the onset of the disease. He suggests that thrombocytopenia may be an allergic manifestation affecting particularly the megakaryocytes. Stewart[131] points out that bacterial toxins may stimulate the reticulo-endothelial system to an increased destruction of platelets, and he believes it is important, therefore, to remove foci of infection in order to prevent recurrences.



Graph showing the frequency of purpura according to age in 163 patients. Note that there is a decrease in the number of cases in the older age groups and a relative increase in post-operative fatalities.

Giffin[44] believes that splenectomy should be performed first before attempting to remove the focal infections and he concludes with the statement that he knows "of no instance in which recurrence of petechial or purpuric areas has persisted following careful elimination of foci."

The weight of evidence, therefore, points to some type of toxæmia as an etiological factor in production of purpura hemorrhagica. The logical prophylactic treatment is to remove the foci of infection after control of the hæmorrhage has been accomplished.

We are reporting herewith five cases of purpura with splenectomy, two of which were of the so-called acute type.

CASE I.—A. M. W., female, twelve years old, admitted to the service of Doctor Riesman, Philadelphia General Hospital, February 11, 1930. She complained of continuous bleeding from the nose since February 9, 1930. Packing did not control the

bleeding. There was slight oozing of blood from the navel and rather profuse bleeding from the gums. Ecchymoses were found under the conjunctiva, in the fundus of the eye and over the extremities. Many petechia were found in the skin and mucous membranes of the mouth. The skin showed a definite pallor. The Hess capillary resistance test was positive. The spleen was not palpable. Temperature, 98.6°; pulse, 136; respirations, 24; blood-pressure, 102/40. Blood.—Red blood-cells, 1,800,000; hæmoglobin, 33 per cent.; reticulated red cells, 3 per cent.; white blood-cells, 10,500; polymorphonuclears, 80 per cent.; lymphocytes, 16 per cent.; mononuclears, 4 per cent. Platelets, 40,000. Bleeding time, thirteen minutes. The clot did not retract.

A diagnosis of thrombopenic purpura hemorrhagica was made. Two injections of ten cubic centimetres of thromboplastin were given. Nasal packing was inserted.

February 12, 1930.—Nasal packing changed. Röntgen deep therapy over spleen, 20 per cent. erythema dose. Transfusion 500 cubic centimetres citrated blood. Bleeding constantly.

February 13, 1930.—Temperature, 100°; pulse, 140; respirations, 25. Continuous hæmorrhage from nose and gums. Vomiting blood. Patient rapidly growing weaker. 4 P.M.—Splenectomy, 500 cubic centimetres blood given by transfusion during the operation. The bleeding from the nose stopped during the operation and transfusion. Pulse at end of operation, 120. 10 P.M.—No further signs of hæmorrhage.

February 14, 1930.—No further hæmorrhage. Red blood-cells, 2,750,000; platelets, 160,000.

February 15, 1930.—Transfusion 300 cubic centimetres citrated blood.

February 16, 1930.—Slight bleeding from nose for short time after child had "picked" her nose.

February 17, 1930.—Red blood-cells, 3,550,000; hæmoglobin, 63 per cent.; white blood-cells, 18,000; platelets, 125,000.

February 24, 1930.—Red blood-cells, 3,460,000; hæmoglobin, 65 per cent.; white blood-cells, 8,400; platelets, 120,000.

March 9, 1930.—Wound healed. No further bleeding. Patient discharged. Red blood-cells, 3,500,000; platelets, 160,000.

June 11, 1930.—No recurrence of bleeding. Patient has gained much weight. Red blood-cells, 5,530,000; hæmoglobin, 100 per cent.; white blood-cells, 17,700; platelets, 70,000.

December 3, 1930.—Symptom-free. No recurrence of bleeding. Weight, 116½ pounds. Red blood-cells, 4,610,000; hæmoglobin, 100 per cent.; white blood-cells, 13,850; platelets, 230,000.

June 20, 1931.—No recurrence. Weight 125½ pounds. Red blood-cells, 4,310,000; white blood-cells, 12,400; hæmoglobin, 90 per cent.; platelets, 100,000.

May 10, 1932.—No recurrence. Weight 154 pounds. Bleeding time, two minutes. Red blood-cells, 4,550,000; white blood-cells, 13,600; hæmoglobin, 90 per cent.; platelets, 260,000.

CASE II.—M. G., male, seven years old, admitted to Doctor Lowenburg's service at the Mt. Sinai Hospital, Philadelphia, June 16, 1930, complaining of "blue marks on the body." He had noticed the spots for about three years and they did not always follow trauma. Until his tonsillectomy three years before admission he had had frequent cold and "sore throat." Temperature, 99.6°; pulse, 90. The child was markedly emaciated. The cervical glands were enlarged. There were submucous hæmorrhages on his cheeks, tongue, and pharynx, and multiple petechia and ecchymoses on the trunk and extremities. The spleen was just palpable. Blood.—Red blood-cells, 4,700,000; hæmoglobin, 80 per cent.; platelets, 250,000. Coagulating time, 4½ minutes. Bleeding time, 19 3/8 minutes. Friable, non-retracted clot after twenty-four hours.

July 3, 1930.—Bleeding not marked but has not entirely stopped. Red blood-cells,

4,490,000; hæmoglobin, 80 per cent.; platelets, 140,000. Bleeding time, thirty-one minutes.

July 10, 1930.—Splenectomy.

July 31, 1930.—Recovery uneventful. All bleeding ceased. Discharged. Platelets, 210,000. Bleeding time, 2½ minutes. Solid retracted clot.

January, 1931.—Purpuric spots reappeared and bleeding from gums was noted.

February 17, 1931.—Readmitted. Red blood-cells, 4,490,000; hæmoglobin, 80 per cent. Coagulation time, five minutes. Bleeding time, nine minutes. Platelets, 160,000.

February 23, 1931.—Blood transfusion. Ultra-violet light exposure. Petechia appeared on extremities and chest after confusion. March 3, 1931.—Petechia clearing up. Platelets, 130,000. Calcium gluconate daily. March 23, 1931.—Improving. Bleeding time, 2 1/3 minutes. Platelets, 140,000. March 28, 1931.—Discharged.

April 28, 1931.—No bleeding since discharge from hospital but his mother says "he bruises easily." Red blood-cells, 4,780,000; hæmoglobin, 85 per cent.; white blood-cells, 14,700; polymorphonuclears, 70 per cent.; lymphocytes, 29 per cent.; large mononuclears, 1 per cent. Coagulation time, three minutes. Bleeding time, eighteen minutes. Platelets, 120,000. No solid clot after eighteen hours at 37° C. This patient suffers from frequent upper respiratory infections and probably has a focus of infection in the nose or sinuses, which has not been cleared up.

CASE III.—R. C., female, thirty-three years old, was admitted to the service of Doctor Jump at the Philadelphia General Hospital, April 17, 1931, complaining of bleeding from the gums and vagina. For the past four years her periods had gradually become more profuse. In December, 1930, she was forced to stop her work because of bleeding from mucous membranes. Since April 10, 1931, she had bled from the gums and vagina. She was so weak that she had to come to the hospital. She gave a history of rheumatism in 1923 and of profuse bleeding following the extraction of teeth. There was no familial tendency to bleed. There was continuous bleeding from the gums and large areas of submucous hæmorrhage on the tongue and mucosa of the mouth. The nose contained clots. Petechia were evident in the mucous membranes, conjunctiva and skin. The vagina was pale. There were several hæmorrhagic areas on the labia. When the labia were separated about two ounces of liquid blood escaped. The uterus and vagina failed to show any ulcerations or neoplasm. Large ecchymotic areas were found on the right thigh. Red blood-cells, 2,040,000; hæmoglobin, 30 per cent.; white blood-cells, 7,400; platelets, 40,000. Coagulation time, four minutes. Bleeding time, fifteen minutes +.

April 18, 1931.—450 (c.c.) citrated blood by transfusion. Antivenin ten cubic centimetres intravenously and ten cubic centimetres intramuscularly. Calcium lactate given by mouth in large doses. Bleeding not checked by these measures.

April 20, 1931.—Red blood-cells, 1,900,000; hæmoglobin, 31 per cent.; white blood-cells, 7,900; platelets, 40,000. Bleeding has decreased. April 23, 1931.—Bleeding stopped entirely. Red blood-cells.—1,190,000; hæmoglobin, 30 per cent.; white blood-cells, 16,900; platelets, 320,000.

May 3, 1931.—No further bleeding. Red blood-cells, 2,140,000; hæmoglobin, 40 per cent.; white blood-cells, 9,700; platelets, 350,000.

May 10, 1931.—Bleeding began again from gums. Thromboplastin, twelve cubic centimetres intramuscularly.

May 11, 1931.—Bleeding from gums, nose and vagina. Red blood-cells, 2,380,000; hæmoglobin, 50 per cent.; platelets, 80,000. Bleeding time, twenty-seven minutes. Patient desensitized to antivenin and given ten cubic centimetres intramuscularly.

May 12, 1931.—Profuse bleeding continues. Splenectomy and transfusion.

May 13, 1931.—Bleeding from mucous membranes has stopped. Red blood-cells, 2,640,000; white blood-cells, 17,600; platelets, 210,000. Bleeding time, five minutes.

May 14, 1931.—Slight vaginal bleeding, may be old blood. Red blood-cells, 1,420,000; hæmoglobin, 35 per cent.; platelets, 350,000. Bleeding time, three minutes.

May 17, 1931.—No further bleeding. Purpuric areas are disappearing. May 25, 1931.—Bleeding time, one minute. June 4, 1931.—No further bleeding. Red blood-cells, 3,170,000; platelets, 350,000. We have been unable to locate this patient.

CASE IV.—M. T., male, aged twenty years, was admitted to the service of Doctor Stengel, University Hospital, Philadelphia, February 6, 1931, complaining of bleeding from nose. He has had frequent nose bleeds since he was ten years old. His present attack began one week before his admission and could not be controlled by nasal packing. He had never noted any unusual bleeding from cuts or bruises and there was no familial history of bleeding. At the time he was examined there was continuous bleeding from his nose and gums, and petechia were evident in the skin and mucous membranes. Red blood-cells, 3,300,000; white blood-cells, 24,000; hæmoglobin, 56 per cent.; platelets, too few to count. Bleeding time, 2½ minutes. Coagulation time, five minutes. Slightly retracted clot in twenty-four hours. Tourniquet test, positive.

February 7, 1931.—Patient developed an otitis media of the right ear from which pus is draining.

February 10, 1931.—Still bleeding. Transfusion 500 cubic centimetres citrated blood, fifty cubic centimetres whole blood injected intramuscularly. Platelets, 16,000.

February 11, 1931.—Splenectomy and transfusion. Platelets, 9,200. February 12, 1931.—Still oozing slightly from the nose. Transfusion 500 cubic centimetres.

February 16, 1931.—Slight bleeding from nose. Platelets, 15,000. Bleeding time, 2½ minutes. Slight clot retraction. Transfusion 350 cubic centimetres.

February 28, 1931.—Transfusion 500 cubic centimetres. Still slight bleeding from nose. March 13, 1931.—Platelets, 51,200. Still same ooze from right nostril. Ear is improved. March 23, 1931.—Violent nose bleed today. Platelets, 3,000. Antivenin given intramuscularly. March 26, 1931.—Nasal bleeding slight. Petechia have appeared in the skin of the trunk and extremities. Platelets, 57,600. April 7, 1931.—Patient has had slight bleeding from the nose for past five days. Platelets, 48,000. April 20, 1931.—No bleeding. Patient signed his release from hospital. Platelets, 16,800. May 18, 1931.—No further bleeding. Platelets, 22,400.

May 8, 1932.—Slight epistaxis on two occasions. Working daily. Red blood-cells, 5,100,000; hæmoglobin, 90 per cent.; white blood-cells, 6,800; platelets, 110,400. Bleeding time, one minute.

CASE V.—R. V., male, aged two years, seven months, was admitted September 30, 1931, to the Pædiatric Service, University Hospital, Philadelphia, complaining of blue marks on the skin. He had been normal until the week before admission when bluish spots appeared on the epigastrium and on the legs. Petechia were present on the face and neck. There was a small subconjunctival hæmorrhage in the left eye. The teeth were markedly carious. Hæmorrhages were noted in the hard and soft palate. Red blood-cells, 4,800,000; hæmoglobin, 75 per cent.; white blood-cells, 15,000; platelets, 2,500. Bleeding time, one hour. Clotting time, seven minutes. No clot retraction in seventeen hours.

October 2, 1931.—Platelets, 3,200. Transfusion, 200 cubic centimetres. Platelets after transfusion, 8,000. October 3, 1931.—Platelets, 28,000. Some blood in stool. October 5, 1931.—Platelets, 18,000. Transfusion, 140 cubic centimetres. Large purpuric area on the lateral aspect of left thigh. Whole blood five cubic centimetres given intramuscularly every third day. October 7, 1931.—Platelets, 12,800; red blood-cells, 4,000,000; hæmoglobin, 100 per cent.

October 9, 1931.—Splenectomy. Spleen very small. Transfusion 100 cubic centimetres. Post-operative blood, red blood-cells, 5,200,000; white blood-cells, 41,400; hæmoglobin, 90 per cent.; Platelets, 38,400. October 10, 1931.—Platelets, 234,000. October 12, 1931.—Platelets, 896,000. October 14, 1931.—Platelets, 540,000. October

22, 1931.—Platelets, 326,000. November 4, 1931.—Platelets, 672,000. Bleeding time, 2½ minutes. No further bleeding since operation. Discharged.

November, 1931.—Tonsillectomy and teeth extraction. No undue bleeding. April 27, 1932.—No bleeding since operation. Patient has gained eight pounds in weight. Red blood-cells, 4,000,000; hæmoglobin, 78 per cent.; white blood-cells, 11,900; platelets, 330,000. Bleeding time, 1½ minutes. Clot retractility, normal. Clotting time, ten minutes.

In order to have some basis on which to judge the results and dangers of splenectomy in purpura hemorrhagica we have collected and analyzed all of the cases we were able to find in the literature up to 1932. The two previous analyses of cases were those of Whipple in 1926[136] of eighty-one cases and of Spence in 1928[128] of 101 cases. In Spence's report the case of Farley and of Lee is the same patient making 100 cases reported by Spence. He also included all but five of Whipple's eighty-one cases, so that the combined reports of Whipple and Spence contain 105 individual cases. We have collected an additional 103 cases from the literature and are adding five unreported cases of our own, making a total of 213 cases upon which our analysis has been made. The data have not always been available for a complete analysis and in such instances the figures given are based on the cases in which the significant data have been found.

The cases have been divided into the conventional chronic and acute types in order that our figures may be comparable to the previous reports. Of the 213 cases, thirty-five were classified as acute, 160 as chronic and in eighteen cases it was impossible to classify the type of purpura.

Results.—Of the 213 patients, twenty-eight died as a result of or shortly after operation, a mortality for the whole group of 13.1 per cent. Spence reported 100 cases with twenty deaths, a mortality of 20 per cent. In the 113 additional cases there were only eight deaths, a reduction in the period 1928 to 1932 to 7.08 per cent. The results in the remaining patients may be classified as follows:

"Cures"	156 cases	73.2%
Improved	17 cases	8.0%
Unimproved	6 cases	2.8%
Result unknown	6 cases	2.8%

Cases were classified as cured if they had recovered from their operations and had no further bleeding up to the time when the report was made. This may not be a true picture of the results because at least forty-seven cases were reported within six months from the time of operation, and twenty-eight more between six months and a year after splenectomy. The remaining cases were reported as follows:

1 to 2 years after splenectomy	26 cases
2 to 3 years after splenectomy	12 cases
3 to 4 years after splenectomy	3 cases
4 to 5 years after splenectomy	12 cases
Over 5 years after splenectomy	5 cases
Unknown time after splenectomy	24 cases

To date there have been no large series of cases reported from which it is possible to evaluate the five-year results.

Results in Acute Purpura Hemorrhagica

Acute purpura	35 cases	
Cures	22 cases	65.7%
Improvement	1 case	
Deaths	12 cases	34.3%

These figures are at variance with those of Whipple and Spence. Whipple reported seven deaths in the eight cases of acute purpura with splenectomy, and Spence found ten deaths in twelve cases operated upon, a mortality of 83.3 per cent. Since his report there have been twenty-two cases of acute purpura with only three deaths, a mortality of only 13.6 per cent. in the cases reported since 1928. This figure approaches the mortality figures in chronic purpura. It is probable that the decrease in mortality noted in the above figures may be attributed to a tendency to earlier splenectomy and especially to an improvement in the preparation of these patients for operation.

Results in Chronic Purpura Hemorrhagica

Chronic purpura	160 cases	
Cures	124 cases—77.5%	88.1%
Improved	17 cases—10.6%	
Unimproved	4 cases— 2.5%	
Deaths	11 cases— 7.0%	
No follow-up	4 cases— 2.5%	

In Whipple's report there were seventy-three chronic cases, of which six died, a mortality of 8.2 per cent. Spence found a mortality of 11.8 per cent. There has been, therefore, also a reduction in the mortality figures for splenectomy in chronic purpura during the period 1928 to 1932.

Results in Unclassified Purpura Hemorrhagica

Total cases	18
Cures	10 cases—55.5%
Improved	1 case
Deaths	5 cases—27.8%
No follow-up	2 cases

If it were possible to accurately classify these cases, it would naturally increase slightly the mortality figures for the so-called acute and chronic cases.

In investigating the cause of death, it was found that all but one of the acute cases died either on the operating table or on the day of operation. There was one patient who lived until the tenth post-operative day. The factor of delay in operation, and markedly decreased red blood-cells and hæmoglobin was evident in all but two cases, and in these cases the last blood studies given were those several days or more before operation, so that it is probable that these patients too were well bled out at the time of operation.

The deaths in the so-called chronic cases may be grouped under four chief heads: Operative shock, delayed operation, three cases; post-operative intracranial hæmorrhage, three cases; operative accident or post-operative complications, three cases; splenectomy in atypical cases, two cases. Both of the latter cases died some time after operation with the typical picture of aleukæmic leukæmia.

The cases of unclassified purpura died from the same causes: three from operative shock, one three months after operation and from myelogenous leukæmia, and one from cerebral hæmorrhage. In summarizing the causes of death after splenectomy for purpura hemorrhagica, it appears that the most frequent factor is a controllable one, post-operative shock in an anæmic patient. This cause of death appeared evident in eighteen of the twenty-eight fatal cases. Intracranial hæmorrhage led to a fatality in four cases. Operative accidents or complications occurred in three cases and in three cases there was probably an error in diagnosis.

SUMMARY

(1) A review of the literature points to the fact that purpura hemorrhagica is a disease causing not only a reduction of blood-platelets but also a disturbance of the entire reticulo-endothelial system.

(2) It has not yet been proven that the spleen is the organ at fault in purpura hemorrhagica.

(3) A definitely established diagnosis must be made before splenectomy should be considered.

(4) Once the diagnosis is established, the therapeutic indications appear to be (1) control of hæmorrhage, (2) removal of etiological factors.

(5) Splenectomy appears to be the most effective method of controlling extensive hæmorrhage in purpura hemorrhagica of either the acute or recurring type.

(6) Early operation and adequate preparation of the patient by transfusion is imperative.

(7) Removal of foci of infection is the best prophylaxis against recurrences.

(8) Five additional cases of purpura hemorrhagica with splenectomy are reported.

(9) A review of the results obtained in 213 reported cases has been made.

(10) The operative mortality for the whole group was 13.1 per cent. but in the cases collected from the last four years the mortality is only 7.08 per cent. in 113 cases.

(11) In acute purpura, there were thirty-five cases treated by splenectomy with twelve deaths, 34.3 per cent. In the last twenty-two cases there were only three deaths, 13.6 per cent.

(12) In the chronic purpuras there were 160 cases with eleven deaths, 7 per cent.

(13) In eighteen of the twenty-eight cases the cause of death appeared to be post-operative shock in a poor-risk patient; less frequent causes were intracranial hæmorrhage, operative accidents or post-operative complications or incorrect diagnoses.

(14) One hundred eight cases are collected and analyzed.

SUMMARIES OF REPORTED CASES OF SPLENECTOMY FOR THROMBOCYTOPENIC PURPURA HEMORRHAGICA

(Not including the eighty-one cases reported by Whipple in 1926 or the 101 cases reported by Spence in 1928)

CASE I by Fitz Hugh,[37] 1925. Female, eight years, chronic (three months). Red blood-cells, 3,600,000; hæmoglobin, 52 per cent.; bleeding time, 8 to 30 minutes; platelets, 6,000 to 30,000. X-radiation and sterilized-milk injections did not produce remission. After splenectomy, bleeding time, 1¾ minutes; platelets, 74,000 to 273,000. No further bleeding but clot remained non-retractile. Reported four months after splenectomy. Cure.

CASE II by Beer,[7] 1926. Male, fifteen years, chronic (3½ years). Red blood-cells, 2,010,000; hæmoglobin, 28 per cent.; bleeding time, 4½ minutes; platelets, 10,000 to 24,000. X-radiation and transfusions before operation. After splenectomy, bleeding time, three minutes; platelets, 22,000 to 4,000. Slight oozing from wound stopped on tenth post-operative day. Retraction of clot returned. Reported four years after splenectomy. Cure.

CASE III by Beer,[7] 1926. Female, seventeen years, chronic (nine months). Red blood-cells, 5,120,000 to 2,010,000; hæmoglobin, 94 to 69 per cent.; bleeding time, forty-two minutes; platelets, 10,000. Transfusions and radiotherapy before operation. After splenectomy, bleeding time, seven to two minutes; platelets, 12,000 to 80,000. Bleeding from uterus two weeks after operation. Checked by radiotherapy. Reported two years after splenectomy. Cure.

CASE IV by Beer,[7] 1926. Male, eighteen years, chronic (2½ months). Red blood-cells, 3,840,000; hæmoglobin, 76 per cent.; bleeding time, fourteen minutes; platelets, 5,000. After splenectomy, bleeding time, 2½ minutes; platelets, 130,000. Patient in perfect health. Reported seven months after splenectomy. Cure.

CASE V by Beer,[7] 1926. Male, thirteen years, chronic (four weeks). Red blood-cells, 3,472,000; hæmoglobin, 67 per cent.; bleeding time, ten minutes; platelets, 20,000. After splenectomy, bleeding time (?); platelets, 550,000. Patient in excellent health. Reported five months after splenectomy. Cure.

CASE VI by Beer,[7] 1926. Female, twenty-two years, chronic (six months). Red blood-cells, 1,168,000; hæmoglobin, 22 to 33 per cent.; bleeding time, ten minutes; platelets, 2,500. Transfusions before operation. After splenectomy, bleeding time (?), platelets (?). Died three hours after operation. No autopsy. Death.

CASE VII by Falconer and McLachlan,[35] 1926. Female, ten years, chronic (three months). Red blood-cells, (?); hæmoglobin, (?); bleeding time, prolonged; platelets, occasional. Thrombin injections, calcium lactate, intravenous afenil, transfusions. After splenectomy, bleeding time, (?); platelets, (?). No bleeding after operation. Reported two months after splenectomy. Cure.

CASE VIII by Falconer and McLachlan,[35] 1926. Female, twenty-eight years, chronic (eight months). Red blood-cells, 800,000; hæmoglobin, (?); bleeding time, eleven to fifteen minutes; platelets, scanty. Transfusions before operation. After splenectomy, bleeding time, four minutes; platelets—no apparent increase found. Clinically cured. Death followed spontaneous delivery of stillborn child two months after operation. Reported two months after splenectomy. Cure (?).

CASE IX by Harris,[56] 1926. Female, eleven years, chronic (three years). Red blood-cells, 3,880,000 to 3,260,000; hæmoglobin, 85 to 75 per cent.; bleeding time, twenty-five to thirty minutes; platelets, 12,500 to 16,600. Packing, transfusion and tampon

before operation. After splenectomy, bleeding time, two to six minutes; platelets, 595,000 to 504,000. No recurrence. Reported eight months after splenectomy. Cure.

CASE X by Hodges,[63] 1926. Female, fifteen years, chronic (one year). Red blood-cells, 3,970,000 to 5,000,000; hæmoglobin, 55 to 85 per cent.; bleeding time, twelve minutes; platelets, 40,000 to 16,000. Transfusion before operation. After splenectomy, bleeding time, four minutes; platelets, 198,000 to 1,200,000. Periods reëstablished normally. Reported one year after operation. Cure.

CASE XI by Kerlin,[77] 1926. Female, fourteen years, chronic (seven years). Red blood-cells, 1,240,000 to 2,730,000; hæmoglobin, 65 to 40 per cent.; bleeding time, five minutes; platelets, 35,000 to 40,000. D and C, radium, transfusions before operation. After splenectomy, bleeding time, four minutes; platelets, 40,000 to 160,000. Patient gaining weight and strength. Reported one year after splenectomy. Cure.

CASE XII by Reilingh,[118] 1926. Female, forty-nine years, chronic (2½ years). Red blood-cells, (?); hæmoglobin, (?); bleeding time, (?); platelets, (?). Calcium chloride, peptone before operation. After splenectomy, bleeding time, (?); platelets, 24,000 to 1,017,000. No post-operative hæmorrhages. Reported five months after operation. Cure.

CASE XIII by Crawford and Ogilvie,[20] 1927. Female, seven and one-half years, chronic (two years, one month). Red blood-cells, 2,500,000 to 3,400,000; hæmoglobin, 25 per cent.; bleeding time, thirty to twenty minutes; platelets, 7,700 to 3,000. Transfusions, horse serum (intramuscular), tonsillectomy, before operation. After splenectomy, bleeding time, four to seven to six minutes; platelets, 40,000 to 21,000. Patient well six months after operation. Reported six months after splenectomy. Cure.

CASE XIV by Crawford and Ogilvie,[20] 1927. Female, seven years, chronic (five months). Red blood-cells, 4,500,000; hæmoglobin, 80 per cent.; bleeding time, twelve minutes; platelets, 22,000. Transfusions before operation. After splenectomy, bleeding time, 0 to two minutes; platelets, 800,000 to 1,500,000 to 200,000. No purpura since operation. Reported four months after splenectomy. Cure.

CASE XV by De Leeuw,[24] 1927. Sex (?), thirty-six years, chronic (twenty-two years). Red blood-cells, 1,600,000; hæmoglobin, 63 per cent.; bleeding time, eight minutes; platelets, 3,800. Transfusions before operation. After splenectomy, bleeding time, 3½ to 4 minutes; platelets, 190,000. Cure.

CASE XVI by Marin,[96] 1927. Male, eleven years, chronic (eight years). Red blood-cells, 3,500,000; hæmoglobin, 75 to 40 per cent.; bleeding time, twenty-five to thirty minutes; platelets, 25,000 to 15,000. After splenectomy, bleeding time, 1 to 3½ minutes; platelets, 880,000 to 250,000. Cure.

CASE XVII by Muller,[104] 1927. Female, twenty-six years, chronic (four months). Red blood-cells, (?); hæmoglobin, (?); bleeding time, (?); platelets, 10,000 to 30,000. After splenectomy, bleeding time, (?); platelets, 100,000. Reported two years after splenectomy. Cure.

CASE XVIII by Muller,[104] 1927. Female, twenty-six years, chronic (fifteen years). Red blood-cells, (?); hæmoglobin, (?); bleeding time, (?); platelets, 5,000. After splenectomy, bleeding time, (?); platelets, 160,000. Reported six years after splenectomy. Cure.

CASE XIX by Narog,[106] 1927. Male, eighteen years. Cure.

CASE XX by Schaack,[123] 1927. Female, nineteen years, chronic (six years). Red blood-cells, 4,000,000 to 4,500,000; hæmoglobin, 40 per cent.; bleeding time, twenty-seven minutes; platelets, few. After splenectomy, bleeding time, (?); platelets, 125,000 to 568,000. Next period normal. Cure.

CASE XXI by Schaak,[125] 1927. Female, thirty-five years, chronic (twenty years). Red blood-cells, 3,000,000 to 4,000,000; hæmoglobin, 40 to 75 per cent.; bleeding time, prolonged; platelets, 8,000. Gelatinum, ergotin, calcium solutions before operation. After splenectomy, bleeding time, three minutes; platelets, 300,000 to 92,000. Patient well. Reported six months after splenectomy. Cure.

CASE XXII by Schaak,[125] 1927. Female, twenty-eight years, chronic (thirteen years). Red blood-cells, 3,000,000 to 4,500,000; hæmoglobin, 60 to 70 per cent.; bleeding time, twenty to thirty minutes; platelets, 1,000 to 2,000. Protein therapy, X-ray. Eight months in bed. Gelatinum, calcium before splenectomy. After splenectomy, bleeding time, 4 to 4½ minutes; platelets, 115,000 to 400,000. Patient well. Reported two months after splenectomy. Cure.

CASE XXIII by Ceballos and Taubenschlag,[16] 1928. Female, thirty-two years, acute (nine days). Red blood-cells, 2,440,000; hæmoglobin, 34 per cent.; bleeding time, prolonged; platelets, none. Sulpharsenol, lavages, serum, propidon, transfusion before operation. After splenectomy, bleeding time, (?); platelets, normal. Hæmorrhages not repeated after operation. Reported 1½ years after splenectomy. Cure.

CASE XXIV by Emil-Weil and Grégoire,[81] 1928. Sex, (?), thirty-one years, chronic (nineteen years). Red blood-cells, 1,883,000 to 4,800,000; hæmoglobin, 85 per cent.; bleeding time, four to twenty-nine minutes; platelets, (?). Transfusions, nasal packing before operation. After splenectomy, bleeding time, 1½ to 6 minutes; platelets, 210,000. Patient in good condition. Reported four months after splenectomy. Cure.

CASE XXV by Gosset, Chevalier and Gutmann,[48] 1928. Female, age, (?), chronic (thirteen years). Red blood-cells, 2,305,000; hæmoglobin, 40 per cent.; bleeding time, sixteen to thirty minutes; platelets, 180,000. X-ray of long bones before operation. After splenectomy, bleeding time, 2½ to 2 minutes; platelets, 264,000 to 237,000. Bleeding stopped first day. Patient has few nose-bleeds when tired. Cure.

CASE XXVI by Green,[51] 1928. Female, thirty-nine years, chronic (four years). Red blood-cells, 2,000,000 to 4,200,000; hæmoglobin, 48 to 82 per cent.; bleeding time, two minutes; platelets, 70,000 to 500,000. Transfusions and ultra-violet before operation. After splenectomy, bleeding time, two minutes; platelets, 800,000. Epistaxis seven days after operation. Result, unknown.

CASE XXVII by Gregory,[54] 1928. Male, aged seven, chronic (two years). Red blood-cells, 1,765,000; hæmoglobin, 25 per cent.; bleeding time, fifteen minutes; platelets, 47,700. Transfusions before operation. After splenectomy, bleeding time, 20 to 4½ minutes; platelets, 150,000 to 120,000. Patient had one small epistaxis during convalescence and two since. Reported ten months after splenectomy. Improvement.

CASE XXVIII by Jones, H. C.,[70] 1928. Female, thirty-three years, chronic (six months). Red blood-cells, 2,150,000; hæmoglobin, 21 per cent.; bleeding time, 23½ to six to eighteen minutes; platelets, 100,000 to 211,000. Transfusions before operation. After splenectomy, bleeding time, five minutes; platelets, 352,000 to 552,000. Patient well. Reported one year after splenectomy. Cure.

CASE XXIX by Kennedy,[76] 1928. Female, eleven years, chronic (five years). Red blood-cells, (?); hæmoglobin, (?); bleeding time, sixty minutes; platelets, 46,000. After splenectomy, bleeding time, five minutes; platelets, 430,000 to 50,000. Patient had slight epistaxis six weeks after operation. Condition good. Reported four years after splenectomy. Cure.

CASE XXX by Kennedy,[76] 1928. Female, eleven years, chronic (5½ years). Red blood-cells, (?); hæmoglobin, (?); bleeding time, eleven minutes; platelets, 98,000. After splenectomy, bleeding time, three minutes; platelets, 640,000 to 296,000. Condition excellent. Reported four years after splenectomy. Cure.

CASE XXXI by Kennedy,[76] 1928. Female, six years, acute (three weeks). Red blood-cells, (?); hæmoglobin, (?); bleeding time, ninety minutes; platelets, 44,000. After splenectomy, bleeding time, three minutes; platelets, 316,000 to 280,000. Condition excellent. Reported three years after splenectomy. Cure.

CASE XXXII by Kennedy,[76] 1928. Male, ten years, chronic (eight months). Red blood-cells, (?); hæmoglobin, (?); bleeding time, sixty minutes; platelets, 56,000. After splenectomy, bleeding time, (?); platelets, 372,000. Condition excellent. Reported two years after splenectomy. Cure.

CASE XXXIII by Kennedy,[76] 1928. Male, nine years, chronic (three years). Red blood-cells, (?); hæmoglobin, (?); bleeding time, eighteen minutes; platelets, 36,000. After splenectomy, bleeding time, (?); platelets, (?). Condition excellent. Reported two years after splenectomy. Cure.

CASE XXXIV by Kennedy,[76] 1928. Male, four and one-half years, chronic (seven weeks). Red blood-cells, (?); hæmoglobin, (?); bleeding time, forty-eight minutes; platelets, 50,000. After splenectomy, bleeding time, (?); platelets, 328,000 to 120,000. No recurrence. Reported six months after splenectomy. Cure.

CASE XXXV by Kennedy,[76] 1928. Female, eight and one-half years, chronic (four months). Red blood-cells, (?); hæmoglobin, (?); bleeding time, twenty minutes; platelets, 64,000. After splenectomy, bleeding time, two minutes; platelets, 224,000 to 258,000. No recurrence. Reported two years after splenectomy. Cure.

CASE XXXVI by Kennedy,[76] 1928. Female, seven years, chronic (two years). Red blood-cells, (?); hæmoglobin, (?); bleeding time, twenty-eight minutes; platelets, 144,000. After splenectomy, bleeding time, twenty-eight minutes; platelets, 242,000 to 208,000. Condition excellent. Reported two years after splenectomy. Cure.

CASE XXXVII by Kennedy,[76] 1928. Female, nine years, chronic (seven and one-half years). Red blood-cells, (?); hæmoglobin, (?); bleeding time, sixty minutes; platelets, 300,000. After splenectomy, bleeding time, 120 minutes; platelets, 352,000 to 272,000. No epistaxis or purpura following operation. Patient menstruates profusely. Reported four years after splenectomy. Cure.

CASE XXXVIII by Kennedy,[76] 1928. Female, four years, acute (one week). Red blood-cells, (?); hæmoglobin, (?); bleeding time, twenty-six minutes; platelets, 98,000. After operation, bleeding time, thirteen minutes; platelets, 208,000 to 88,000. No improvement following operation. Death followed tonsillectomy two months later. Unimproved.

CASE XXXIX by Lesne, Marquezy and Stieffel,[92] 1928. Female, twenty-three years, chronic (sixteen years). Red blood-cells, 3,400,000; hæmoglobin, 70 per cent.; bleeding time, seventeen minutes to three hours; platelets, 50,000. Hospitalized many times, radiotherapy, serum, anthema, peptone, calcium chloride, thyroid and ovarian extract. After splenectomy, bleeding time, nine to five to thirty minutes; platelets, 200,000 to 50,000. Purpura one month after operation. One epistaxis requiring packing. Judgment reserved. Reported one year after splenectomy. Improvement.

CASE XL by Merklen and Leriche,[100] 1928. Female, seventeen years, chronic (eight months). Red blood-cells, 1,480,000; hæmoglobin, 26 per cent.; bleeding time, forty minutes; platelets, 26,000 to 28,000. Transfusions, irradiations of spleen, coagulen before operation. After splenectomy, bleeding time, four to twenty-one to seven minutes; platelets, 18,200 to 200,000. No bleeding following operation. Reported six months after splenectomy. Cure.

CASE XLI by Pinkerton,[110] 1928. Female, eighteen years, chronic (four months). Red blood-cells, 1,080,000; hæmoglobin, 20 per cent.; bleeding time, thirty minutes; platelets, 18,000. Transfusion, nasal packing, hemostatics before operation. After splenectomy, bleeding time, 2½ minutes; platelets, 80,000 to 20,000. Purpuric spots on ankle twelfth day. Trace of blood from gums fifth and twelfth days. Otherwise uneventful convalescence. Reported four months after splenectomy. Cure.

CASE XLII by Reuben and Claman,[119] 1928. Female, three and one-half years, acute (three days). Red blood-cells, 3,200,000 to 2,700,000; hæmoglobin, 73 to 48 per cent.; bleeding time, prolonged; platelets, 55,000 to 10,000. Transfusions before operation. After splenectomy, bleeding time, (?); platelets, 68,000 to 590,000. Patient operated upon for acute mastoiditis following splenectomy and complete healing took one year. Now well in every respect. Reported eighteen months after splenectomy. Cure.

CASE XLIII by Reuben and Claman,[119] 1928. Male, six and one-half years, chronic (three months). Red blood-cells, 4,500,000; hæmoglobin, 70 per cent.; bleeding time, fifteen minutes; platelets, 78,000. Transfusions, alpine treatments, milk injections,

adrenalin before operation. After splenectomy, bleeding time, (?); platelets, 385,000 to 487,000. No recurrence. Reported four months after splenectomy. Cure.

CASE XLIV by Reuben and Claman,[119] 1928. Female, nine and one-half years, acute (nine days). Red blood-cells, 3,500,000; bleeding time, twenty minutes; platelets, 40,000 to 50,000. "All medical measures," transfusions before splenectomy. After splenectomy, bleeding time, 3½ to 45 to 17 minutes; platelets, 43,000—few. Patient clinically cured but still has thrombopenia, delayed clot retraction, increased bleeding time. Reported three months after splenectomy. Cure.

CASE XLV by Reuben and Claman,[119] 1928. Male, seven years, chronic (two years). Red blood-cells, (?); hæmoglobin, (?); bleeding time, seven minutes; platelets, 20,800 to 124,000. Transfusions before operation. After splenectomy, bleeding time, (?); platelets, (?). Purpuric spots after splenectomy; also bleeding from mucous membrane. Improvement.

CASE XLVI by Reuben and Claman,[119] 1928. Male, eight years, chronic (four months). Red blood-cells, 3,900,000; hæmoglobin, 68 per cent.; bleeding time, three and one-half minutes; platelets, 60,000. Transfusion and "other treatment" before operation. After splenectomy, bleeding time, (?); platelets, 62,000 to 483,400. Condition excellent. Reported one year after splenectomy. Cure.

CASE XLVII by Rhame,[120] 1928. Female, seventeen years, chronic (three months). Red blood-cells, 4,272,000; hæmoglobin, 85 to 86 per cent.; bleeding time, twenty-five to eight minutes; platelets, 78,000 to 149,000. Horse serum, nasal packing, calcium chloride, transfusion before operation. After splenectomy, bleeding time, three minutes; platelets, 220,000 to 374,000. Slight bleeding from uterus checked on fourth day. Patient in excellent health. Reported three months after splenectomy. Cure.

CASE XLVIII by Schiassi,[127] 1928. Female, forty years. Other data (?). After splenectomy, no hemorrhagic symptoms. Reported four months after splenectomy. Cure.

CASE XLIX by Stewart,[131] 1928. Female, three and one-half years, chronic (one year). Red blood-cells, 3,552,000 to 4,530,000; hæmoglobin, 61 to 52 per cent.; bleeding time, seven minutes; platelets, 50,000 to 22,000. Calcium lactate, ultra-violet radiation, transfusions before operation. After splenectomy, bleeding time, one and one-half minutes; platelets, 40,000 to 240,000. No recurrence. Reported three and one-half months after splenectomy. Cure.

CASE L by Stewart,[131] 1928. Female, six and one-half years, chronic (sixteen months). Red blood-cells, 2,184,000 to 1,345,000; hæmoglobin, 70 to 22 per cent.; bleeding time, eight to fourteen to 3½ minutes; platelets, 300,000 to 84,000 to 235,000 to 115,000. Transfusion, liver diet, ultra-violet before operation. After splenectomy, bleeding time, five minutes; platelets, 100,000 to 380,000 to 290,000. Reported five and one-half months after splenectomy. Cure.

CASE LI by Anschütz,[2] 1928. Female, forty-two years, acute (two days). Red blood-cells, 4,200,000 to 2,460,000; hæmoglobin, 85 to 45 per cent.; bleeding time, prolonged; platelets, 32,000. Transfusion before operation. After splenectomy, bleeding time, two hours; platelets, 320,000; platelets at one year are 319,000. Reported one year after splenectomy. Cure.

CASE LII by Bykowa,[13] 1928. Male, thirty-one years, acute (four weeks). Red blood-cells, 4,800,000; hæmoglobin, 97 per cent.; bleeding time, (?); platelets, 64,200. After splenectomy, bleeding time, (?); platelets, (?). Death first post-operative day.

CASE LIII by Raine, Yates, and Davis,[116] 1928. Female, fifteen years, chronic (one month). Red blood-cells, 1,250,000 to 3,560,000; hæmoglobin, 44 per cent.; bleeding time, (?); platelets, few—165,000. Transfusions, X-ray before operation. After splenectomy, bleeding time, (?); platelets, 87,500 to 375,000. No further bleeding. Reported six months after splenectomy. Cure.

CASE LIV by Schaack,[124] 1928. Male, twenty-seven years, chronic. Red blood-cells, 3,220,000; hæmoglobin, 82 per cent.; bleeding time, two minutes; platelets, 59,000. After

splenectomy, bleeding time, (?); platelets, 274,000 to 466,000. No recurrence. Reported one year after splenectomy. Cure.

CASE LV by Schaack,[124] 1928. Female, forty years, acute (five weeks). Red blood-cells, 1,200,000; hæmoglobin, 20 per cent.; bleeding time, twenty-nine minutes; platelets, 25,000. Transfusion before operation. After splenectomy, bleeding time, (?); platelets, 100,000 to 350,000. Clinically cured. Death from pneumonia four months. Cure.

CASE LVI by Woenckhaus,[139] 1928. Male, thirty years, chronic (two years). Red blood-cells, 5,060,000; hæmoglobin, 74 per cent.; bleeding time, four to five minutes; platelets, 44,000. Serum, X-ray before operation. After splenectomy, bleeding time, (?); platelets, 156,000 to 230,000. Bleeding continued in spite of platelet-count increase, bleeding time and retractility. Reported three months after splenectomy. Improvement.

CASE LVII by Ceballos and Taubenschlag,[14] 1929. Female, chronic (seven months). Red blood-cells, (?); hæmoglobin, (?); bleeding time, prolonged; platelets, 118,000. Citrated blood into left radial artery second and third days before operation. After splenectomy, bleeding time, (?); platelets, 142,000 to 164,720. No blood lost following operation. Reported six months after splenectomy. Cure.

CASE LVIII by Ceballos and Taubenschlag,[15] 1929. Female, thirty-two years, chronic (five months). Red blood-cells, 1,850,000; hæmoglobin, (?); bleeding time, twenty-nine minutes; platelets, scanty. After splenectomy, bleeding time, (?); platelets, almost normal. Cure.

CASE LIX by Ceballos and Taubenschlag,[15] 1929. Female, twenty-five years, chronic (four months). Red blood-cells, 4,700,000 to 2,000,000; hæmoglobin, 85 per cent.; bleeding time, (?); platelets, 50,000 to 8,000. Calcium chloride, glucose, coagulen, transfusions, bed inclined before splenectomy. After splenectomy, bleeding time, (?); platelets, 214,000 to 221,000. Patient was prepared before operation so that hæmorrhages had stopped. Cure.

CASE LX by Ceballos and Taubenschlag,[15] 1929. Female, twenty-five years, chronic (two years). Red blood-cells, 3,000,000; hæmoglobin, (?); bleeding time, eight minutes; platelets, 2,346. Bicyanide of mercury before operation. After splenectomy, bleeding time, (?); platelets, 179,000 to 185,000. Cure.

CASE LXI by Frank,[42] 1929. Male, five years, chronic (two months). Red blood-cells, 1,200,000 to 2,000,000; hæmoglobin, 60 per cent.; bleeding time, sixteen minutes; platelets, 37,000. Transfusions before operation. After splenectomy, bleeding time, (?); platelets, 210,000. No bleeding after operation. Reported five months after splenectomy. Cure.

CASE LXII by Killins,[79] 1929. Male, twenty-four years, acute. Red blood-cells, 1,200,000 to 3,400,000; hæmoglobin, 85 to 70 per cent.; bleeding time, thirty minutes; platelets, 18,000 to 4,000 to 27,000. Transfusion before operation. After splenectomy, bleeding time, normal; platelets, 400,000 to 380,000 to 165,000. Patient in perfect health. Reported three months after splenectomy. Cure.

CASE LXIII by Kogen and Genkin,[80] 1929. Male, twenty years, chronic (eight years). Red blood-cells, 5,660,000 to 4,590,000; hæmoglobin, 93 to 60 per cent.; bleeding time, ten minutes; platelets, 2,000 to 15,000 to 9,300. Calcium chloride, autohemotherapy, horse serum, neosalvarsan, mercury before operation. After splenectomy, bleeding time, 2½ minutes; platelets, 128,000 to 874,000 to 154,000. Patient well. Reported 13½ months after splenectomy. Cure.

CASE LXIV by Koster,[81] 1929. Male, twelve years, six weeks' duration. Red blood-cells, 1,520,000; hæmoglobin, 20 per cent.; bleeding time, twenty minutes; platelets, 68,000. Transfusion before operation. After splenectomy, bleeding time, twelve minutes; platelets, 78,000 to 120,000. Death three months following operation from myelogenous leukæmia. Death.

CASE LXV by Koster,[81] 1929. Female, seven years, chronic (one year). Red blood-cells, 3,400,000; hæmoglobin, 48 per cent.; bleeding time, forty-eight minutes; platelets, 15,700. Transfusions before operation. After splenectomy, bleeding time, twelve

minutes; platelets, 190,000. No recurrence. Reported fifteen months after splenectomy. Cure.

CASE LXVI by Koster,[81] 1929. Female, twenty years, chronic (six months). Red blood-cells, 1,688,000; hæmoglobin, 23 per cent.; bleeding time, twenty-three minutes; platelets, 30,000 to 20,000. Transfusion after operation. After splenectomy, bleeding time, twenty-six minutes, platelets, 350,000. Result unknown.

CASE LXVII by Leriche and Horrenberger,[91] 1929. Male, eleven and one-half years, chronic (six months). Red blood-cells, 5,100,000 to 4,610,000; hæmoglobin, 55 per cent.; bleeding time, twenty-three minutes to four hours to 14½ minutes; platelets, 86,000 to 120,000 to 169,000. Calcium chloride, transfusions, X-ray of spleen, nose, buttocks, both femurs, coagulen, anthema before operation. After splenectomy, bleeding time, twenty-seven minutes; platelets, 68,000 to 400,000 to 600,000. Patient in perfect health. Reported 8½ months after operation. Cure.

CASE LXVIII by Litchfield,[95] 1929. Female, six years, acute (two days). Red blood-cells, 2,260,000; hæmoglobin, 50 to 45 per cent.; bleeding time, fourteen minutes; platelets, 30,000 to 80,000 to 25,000. Intramuscular blood injections, transfusions before operation. After splenectomy, bleeding time, (?); platelets, 250,000 to 525,000. Cure.

CASE LXIX by Plumier-Clermont and Lambrecht,[111] 1929. Female, four and one-half years, chronic (six months). Red blood-cells, 5,000,000; hæmoglobin, 80 to 40 per cent.; bleeding time, ninety-three minutes; platelets, (?); ten cubic centimetres propeptone, 5 per cent. intramuscular weekly hemoplastin injections before operation. After splenectomy, bleeding time, 5½ to 3½ minutes; platelets, 800 to 600,000 to 615,000. Reported two months after operation. Improvement.

CASE LXX by Quénu and Stoïanovitch,[115] 1929. Immediate improvement following operation with death eleven months post-operative. Recurrence.

CASE LXXI by Schaak,[126] 1929. Female, twenty-five years, chronic (nine years). Red blood-cells, 2,300,000; hæmoglobin, 80 per cent; bleeding time, twenty-four minutes; platelets, 8,000. Röntgen-rays and other treatments before operation. After splenectomy, bleeding time, (?); platelets, 500,000. Patient well. Cure.

CASE LXXII by Abrahamsen and Meulengracht,[1] 1930. Female, twenty-four years, chronic (two years). Red blood-cells, 1,800,000 to 4,800,000; hæmoglobin, 28 to 80 per cent.; bleeding time, two hours, prolonged; platelets, 5,000 to 150,000. Transfusions before operation. After splenectomy, bleeding time, two to three minutes; platelets, 90,000 to 603,000 to 17,200. Patient has occasional bleedings. Reported twenty months after splenectomy. Improvement.

CASE LXXIII by Abrahamsen and Meulengracht,[1] 1930. Female, twenty-two years, chronic (eight years). Red blood-cells, 1,700,000; hæmoglobin, 57 to 30 per cent.; bleeding time, fifteen minutes; platelets, 1,000 to 5,000. Serum, pelvic operation before splenectomy. After splenectomy, bleeding time, five to thirty minutes; platelets, 17,000 to 57,000 to 33,000. Petechia, bleeding on slight trauma. Reported fourteen months after splenectomy. Improvement.

CASE LXXIV by Graham,[49] 1930. Female, sixteen years, acute (two days). Red blood-cells, 2,400,000 to 3,136,000; hæmoglobin, 25 to 48 to 20 to 27 per cent.; bleeding time, sixteen minutes; platelets, 31,000 to 40,000 to 136,000. Ergot, transfusions, dilatation, curettage, packing, thromboplastin before splenectomy. After splenectomy, bleeding time, 2½ to 1½ minutes; platelets, 310,000 to 208,000 to 536,000. Vaginal bleeding until fourth post-operative day. Reported five months after splenectomy. Cure.

CASE LXXV by Kerlin,[78] 1930. Female, fourteen years, chronic (eight years). Red blood-cells, 2,060,000 to 1,780,000; hæmoglobin, 60 to 40 per cent.; bleeding time, six minutes; platelets, 49,000 to 40,000. After splenectomy, bleeding time, (?); platelets, 150,000 to 148,000. Condition good. Reported four years after splenectomy. Cure.

CASE LXXVI by Kerlin,[78] 1930. Female, fifteen years, chronic (eleven years). Red blood-cells, 2,120,000 to 1,856,000; hæmoglobin, 65 to 40 per cent.; bleeding time, 10½ minutes; platelets, 140,000 to 82,000. After splenectomy, bleeding time, eight min-

utes; platelets, 136,000 to 260,000. Patient in excellent health. Reported three years after splenectomy. Cure.

CASE LXXVII by Kerlin,[78] 1930. Male, ten years, chronic (seven years). Red blood-cells, 2,720,000; hæmoglobin, 75 per cent.; bleeding time, seven minutes; platelets, 48,000. Transfusions before splenectomy. After splenectomy, bleeding time, sixty minutes; platelets, (?). Death three hours after operation.

CASE LXXVIII by Kerlin,[78] 1930. Female, eighteen years, chronic (two years). Red blood-cells, 1,440,000 to 3,448,000; hæmoglobin, 20 to 45 per cent.; bleeding time, thirty to six minutes; platelets, 270,000 to 370,000 to 160,000. Eight months before operation transfusion, calcium chloride, gelatine, ultra-violet. After splenectomy, bleeding time, 3½ minutes; platelets, 240,000. Condition good. Reported two and one-half months after splenectomy. Cure.

CASE LXXIX by Marsh,[97] 1930. Male, forty-five years, acute (one week). Red blood-cells, 3,300,000 to 4,600,000; hæmoglobin, 58 per cent.; bleeding time, thirty minutes; platelets, 95,000 to 120,000. Transfusions before splenectomy. After splenectomy, bleeding time, 9 to 2½ minutes; platelets, 135,000 to 180,000. No recurrence. Cure.

CASE LXXX by Sakai,[122] 1930. Cure.

CASE LXXXI by Washburn,[135] 1930. Female, fifteen years, chronic (seven years). Red blood-cells, 2,500,000; hæmoglobin, 25 per cent.; bleeding time, 64½ minutes; platelets, 112,000. Transfusions before operation. After splenectomy, bleeding time, ten minutes; platelets, 81,000 to 4,000. Oozing from gums and wound for four days post-operative. Profuse menstruation seventh day, controlled by transfusions. Continuous slight oozing from gums. Slight improvement. Reported four years after splenectomy. Improvement.

CASE LXXXII by Washburn,[135] 1930. Male, four and one-half years, chronic (nine months). Red blood-cells, 4,800,000; hæmoglobin, 75 per cent.; bleeding time, forty-five minutes; platelets, 28,000 to 4,000 to 13,000. Transfusions before operation. After splenectomy, bleeding time, (?); platelets, 1,175,000 to 224,000. No bleeding following operation. Reported eighteen months after splenectomy. Cure.

CASE LXXXIII by Washburn,[135] 1930. Male, four years, chronic (three months). Red blood-cells, 3,600,000; hæmoglobin, 80 per cent.; bleeding time, thirty minutes; platelets, 32,000. Transfusions before operation. After splenectomy, bleeding time, (?); platelets, 2,163,000 to 480,000. Result good. Reported five months after splenectomy. Cure.

CASE LXXXIV by Bloomfield,[10] 1931. Male, thirty-four years, chronic (six months). Red blood-cells, 2,550,000; hæmoglobin, 46 per cent.; bleeding time prolonged; platelets, 9,000. Transfusions, iron, liver, calcium lactate, X-ray before operation. After splenectomy, bleeding time prolonged, normal; platelets, 44,000 to 340,000 to 20,000. No spleen found. Patient was discharged clinically well two months post-operative. Readmitted six weeks later. Death 3½ months post-operative from cerebral hæmorrhage. Death.

CASE LXXXV by deSanctis and Allen,[26] 1931. Male, eight years, acute (two weeks). Red blood-cells, 3,900,000 to 4,200,000 to 3,900,000; hæmoglobin, 68 to 81 to 68 per cent.; bleeding time, 3½ to 6½ minutes; platelets, 60,000 to 33,600 to 14,000. Fluids, stimulants, nasal packing, fibrinogen, thromboplastin, calcium chloride, transfusion before operation. After splenectomy, bleeding time, (?); platelets, 62,000 to 430,000 to 280,000. No recurrence. Reported 4½ years after operation. Cure.

CASE LXXXVI by deSanctis and Allen,[26] 1931. Male, ten years, chronic (two years). Red blood-cells, 2,400,000; hæmoglobin, 50 per cent.; bleeding time, seven minutes; platelets, 31,000. Transfusions before operation. After splenectomy, bleeding time, (?); platelets, 93,500 to 180,000. Patient well. Cure.

CASE LXXXVII by deSanctis and Allen,[26] 1931. Male, five and one-quarter years, chronic (several months). Red blood-cells, 550,000; hæmoglobin, 28 per cent.; bleeding time, four minutes; platelets, 21,700 to 12,000. Packing, transfusion before operation.

After splenectomy, bleeding time, 3½ minutes; platelets, 85,900 to 302,000 to 244,700. Patient weathered lobar pneumonia, myringotomy, mastoidectomy. Repeatedly readmitted for epistaxis which gradually becomes less. Condition good. Reported two years after splenectomy. Improvement.

CASE LXXXVIII by Donovan,[28] 1931. Male, fifty years, acute (three days). Red blood-cells, 3,900,000; hæmoglobin, 69 per cent.; bleeding time, normal; platelets, 80,000 to 25,000. Transfusion before operation. After splenectomy, bleeding time, (?); platelets, 23,000 to 560,000 to 290,000. No post-operative bleeding. Reported thirteen days after operation. Cure.

CASE LXXXIX by Kretzchmar,[88] 1931. Female, thirty-one years, chronic (seven years). Red blood-cells, (?); hæmoglobin, 15 per cent.; bleeding time, twenty minutes; platelets, 30,000. After splenectomy, bleeding time, prolonged; platelets, 500,000. Clinically cured following operation. Recurrence and cure following transfusion. Reported four years after splenectomy. Cure.

CASE XC by Le Marquand and Mills,[90] 1931. Female, fifty-two years, acute (one week). Red blood-cells, 4,300,000; hæmoglobin, 80 to 90 per cent.; bleeding time, (?); platelets, 26,000 to 120,000. Transfusion before operation. After splenectomy, bleeding time, (?); platelets, 400,000. Reported six months after splenectomy. Cure.

CASE XCI by McLean, Kreidel and Caffey,[99] 1931. Acute (one month). Red blood-cells, 2,500,000; hæmoglobin, 40 per cent.; bleeding time, sixty hours; platelets, 32,000 to 56,000. Transfusion before splenectomy. After splenectomy, bleeding time, (?); platelets, (?). Ligation of aberrant gastric vein. Death.

CASE XCII by McLean, Kreidel and Caffey,[99] 1931. Chronic (thirteen months). Red blood-cells, 1,900,000; hæmoglobin, 40 per cent.; bleeding time, ten minutes; platelets, 10,000 to 20,000. Transfusion before operation. After splenectomy, bleeding time, (?); platelets, (?). Bleeding from ninth to twenty-fifth days and death twenty-sixth day. Death.

CASE XCIII by McLean, Kreidel and Caffey,[99] 1931. Acute (forty-eight hours). Red blood-cells, 2,800,000; hæmoglobin, 60 per cent.; bleeding time, fifteen minutes; platelets, 20,000 to 22,000. Transfusion before operation. After splenectomy, bleeding time, (?); platelets, 440,000 to 600,000. Reported two months after splenectomy. Cure.

CASE XCIV by McLean, Kreidel and Caffey,[99] 1931. Chronic (two years). Bleeding time, fifteen minutes; platelets, 10,000 to 16,000. Transfusion before operation. After splenectomy, bleeding time, (?); platelets, 640,000 to 2,200,000 to 824,000. Cure permanent. Reported fourteen months after splenectomy. Cure.

CASE XCV by McLean, Kreidel and Caffey,[99] 1931. Acute (two weeks). Red blood-cells, 2,700,000 hæmoglobin, 40 per cent.; bleeding time, twenty-four minutes; platelets, 32,000 to 17,000. Transfusion before operation. After splenectomy, bleeding time, (?); platelets, (?). Complete hemostasis at operation, death following. Death.

CASE XCVI by McLean, Kreidel and Caffey,[99] 1931. Acute (forty-eight hours). Red blood-cells, 3,300,000; hæmoglobin, 40 per cent.; bleeding time, 6½ hours; platelets, 36,000 to 56,000. Transfusion before operation. After splenectomy, bleeding time, (?); platelets, 328,000 to 1,176,000 to 448,000. Rapid permanent recovery. Reported four years after splenectomy. Cure.

CASE XCVII by Orloff,[107] 1931. Cure.

CASE XCVIII by Portis,[112] 1931. Male, four and one-half years, chronic (five weeks). Red blood-cells, 1,800,000 to 3,200,000 to 2,400,000; hæmoglobin, 30 to 45 to 40 per cent.; bleeding time, 8½ minutes; platelets, 34,000 to 180,000 to 150,000. Transfusions before operation. After splenectomy, bleeding time, four minutes; platelets, 100,000 to 190,000 to 250,000. No recurrence except one severe nose-bleed five months post-operative. Reported six months after operation. Improvement.

CASE XCIX by Proctor,[113] 1931. Female, forty years, chronic (twenty-five years). Red blood-cells, 1,000,000 to 4,000,000; hæmoglobin, 10 to 45 to 55 per cent.; bleeding time, eight to five to seven minutes; platelets, not counted. Transfusions, radium before

operation. After splenectomy, bleeding time eighteen to 1½ to four minutes; platelets, 350,000 to 750,000 to 330,000 to 120,000. Condition good. Reported five months after splenectomy. Cure.

CASE C by Rankin and Anderson,[117] 1931. Male, four years, chronic (one year). Red blood-cells, 3,930,000 to 4,260,000; hæmoglobin, 53 per cent.; bleeding time, sixty to forty minutes; platelets, 30,000 to 40,000, none found. After splenectomy, bleeding time, twenty-five to ten to twenty minutes; platelets, 68,000 to 24,000 to 90,000. Slight nose bleeding until thirteenth day after operation. None since. Reported one month, twenty-three days after splenectomy. Cure.

CASE CI by Smith,[99] 1931. Child, acute (five weeks). Red blood-cells, (?); hæmoglobin, 35 per cent.; bleeding time, (?); platelets, 80,000 to 20,000. Transfusions before operation. After splenectomy, bleeding time, (?); platelets, 157,000 to 300,000. No further bleeding. Reported six weeks after splenectomy. Cure.

CASE CII by Wilkie,[137] 1931. Female, fourteen years, chronic (since infancy). Red blood-cells, 4,600,000; hæmoglobin, 50 per cent.; bleeding time, fourteen minutes; platelets, 18,000. Transfusions before operation. After splenectomy, bleeding time, 4½ minutes; platelets, 150,000 to 230,000 to 190,000. No recurrence. Reported two years after splenectomy. Cure.

CASE CIII by Zondek,[140] 1931. Female, thirty-two years, chronic (fifteen years). Red blood-cells, 4,000,000 to 5,000,000; hæmoglobin, 62 to 73 per cent.; bleeding time up to twenty-three minutes; platelets, 36,000 to 6,000. Transfusions before splenectomy. After splenectomy, clinically well for 4½ years. Sudden recurrence at that time. Recurrence.

CASE CIV by Eliason and Ferguson, 1932. Male, twenty years, chronic (10 years). Red blood-cells, 3,300,000; hæmoglobin, 56 per cent.; bleeding time, 2½ minutes; platelets, few—16,000. Thromboplastin, ceanothyn, transfusion, calcium lactate, antivenin before operation. After splenectomy, bleeding time, 2½ minutes; platelets, 9,200 to 48,000 to 22,000. Continued bleeding for six weeks after operation. None two weeks later. Reported fifteen months after splenectomy. Cure.

CASE CV by Eliason and Ferguson, 1932. Male, seven years, chronic (three years). Red blood-cells, 4,700,000 to 4,490,000; hæmoglobin, 80 per cent.; bleeding time, 19¾ to 3 minutes; platelets, 250,000 to 160,000 to 140,000. On readmission following operation: Transfusion ultra-violet, calcium gluconate. After splenectomy, bleeding time, 2½ to 5 to 2½ minutes; platelets, 210,000 to 130,000 to 140,000. Readmitted seventh post-operative month because of purpuric spots and bleeding from gums. Discharged in six weeks. Reported twenty-two months after splenectomy. Cure.

CASE CVI by Eliason and Ferguson, 1932. Male, two and one-half years, acute (eight days). Red blood-cells, 4,180,000; hæmoglobin, 75 to 100 per cent.; bleeding time, one hour; platelets, 2,500 to 28,800 to 12,800. Transfusion before operation. After splenectomy, bleeding time, (?); platelets, 233,000 to 896,000 to 186,000. Excellent health. Reported seven months after operation. Cure.

CASE CVII by Eliason and Ferguson, 1932. Female, thirty-three years; chronic (three and one-half years). Red blood-cells, 2,040,000 to 1,490,000 to 2,380,000; hæmoglobin, 30 to 40 per cent.; bleeding time, prolonged; platelets, 40,000 to 320,000 to 80,000. Transfusion, antivenin, thromboplastin, calcium lactate before operation. After splenectomy, bleeding time, five to three to one minute; platelets, 210,000 to 350,000. Excellent result. Reported one year after operation. Cure.

CASE CVIII by Eliason and Ferguson, 1932. Female, twelve years, acute (two months). Red blood-cells, 1,800,000 to 2,170,000; hæmoglobin, 28 per cent.; bleeding time, thirteen minutes; platelets, 40,000—two few to count. Nasal packing, X-ray over spleen, thromboplastin, transfusions before operation. After splenectomy, bleeding time, (?); platelets, 160,000 to 125,000 to 160,000 to 70,000 to 230,000 to 100,000. Bleeding from nose third post-operative day, probably due to picking of clots. Reported two years, three months after splenectomy. Cure.

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