HEMOGLOBINEMIA AND HEMOGLOBINURIA

JOSEPH F. ROSS, M.D.


Yuile and his collaborators report a continuation of their well conceived and carefully controlled studies of the mechanism of hemoglobin excretion and its effects on the kidney. They point out that in their experience injections of large amounts of purified solutions of hemoglobin do not produce hemoglobin casts or tubular blockage in normal rabbits, regardless of whether the urine is acid or alkaline, an observation confirmed by several other investigators.

However, injection of hemoglobin solutions into rabbits with pre-existing tubular damage (produced by clamping the renal artery for a period of 15 to 25 minutes or by injecting sodium tetraurate solution) resulted in definite impairment of kidney function. In rabbits with alkaline urine this renal dysfunction was transient and did not result in death. In animals with acid urine extreme renal failure, uremia, and death occurred. Hemoglobin casts were few in number and soon disappeared from the tubules in the animals with alkaline urine, but were numerous, persistent and "indicative of tubular blockage" in the aciduric rabbits.

It was of interest that in instances of extreme pre-existing tubular damage (produced by sodium tetrurate) hemoglobin casts were not found, even in animals with very acid urine. In such instances hemoglobin probably was not excreted by the kidney and thus did not enter the tubular lumina.

The authors conclude that the ultimate outcome in any given instance of hemoglobinuria is dependent upon a fine balance between the degree of renal injury and the level of hemoglobinuria, as well as upon the pH of the urine.


In an attempt to elucidate the etiology of the renal failure occurring in cases of crush injury and transfusion reaction, investigations were made of renal function following injections of myoglobin, metmyoglobin, hemoglobin and hematin into aciduric dogs. Renal function was evaluated from studies of the clearances of diodrast and inulin, and of the tubular secretory capacity for diodrast. Unfortunately the hemoglobin solutions used were simply solutions of lysed dog red blood cells and undoubtedly contained possible toxic substances other than hemoglobin. Solutions of purified pigments would have been more desirable. Control studies on dogs with alkaline urine are not reported.

Renal function was impaired in all experiments, regardless of whether hemoglobin, myoglobin or metmyoglobin was injected, and consisted in an immediate decrease in the tubular secretory capacity followed by a reduction in the renal plasma flow and in the glomerular filtration rate. Impaired function in some instances was greater 48 hours after the injection than during the period of myoglobinuria and persisted in mild degree for the two week period of the study. The renal injury was not severe enough to produce uremia or death, and anatomical studies are not reported.

Hematin was extremely toxic when injected intravenously and produced death from "shock" when given in a dose of 32-6 mg. per Kg. It apparently produced intense efferent arteriolar vasoconstriction in the kidney, glomerular damage, and a marked decrease in renal plasma flow and tubular secretion. Uremia developed in an animal which received the injection of a smaller dose.

The authors attribute the renal injury to (1) obstruction of the tubules by pigment (although they did not demonstrate such obstruction), (2) ingestion of the pigment by tubular cells with resulting impairment of tubular secretory activity (no evidence was presented that ingestion of pigment interferes with tubular function), and (3) "cytotoxic distal tubular activity of intratubularly liberated hematin."
ABSTRACTS

BLOOD SUBSTITUTES

EUGENE L. LOZNER, COMMANDER, MC(S), USNR


This represents a follow-up on the preliminary report previously abstracted (Blood 1: 89, January 1946) by Strumia and associates, on the intravenous administration of a preparation of globin from human erythrocytes. In the present paper seven patients with various types of hypoproteinemias have been treated with globin intravenously. It is apparent that globin is a useful substitute for plasma in this regard. This statement derives chiefly from the fact that globin does not seem to be excreted rapidly as is the case with protein hydrolysates, amino acids or degraded gelatin. However, nitrogen balance and plasma protein studies of much longer duration are required before it can be stated unequivocally that globin is well utilized for the synthesis of body protein. The mere existence of a positive nitrogen balance, when an intravenous protein is being administered, is not sufficient evidence to prove this point. It indicates only that the protein is not rapidly excreted. The concepts of the meaning of a nitrogen balance, that date from the days when ingestion was the only source of nitrogen, will now have to be revised with the introduction of nitrogenous material intravenously. As was stated previously, Strumia's work is quite promising because human erythrocytes are a much richer protein source than plasma and are at present discarded in large amounts. Consequently the preparation of any useful therapeutic agent from this source would indeed be praiseworthy.


Thorn and his associates report on the treatment of seven patients in various stages of chronic nephritis with salt-poor human serum albumin at a dosage of 50 grams a day for varying periods. Significant diuresis was achieved only in those patients with nephrotic anasarca. This diuresis was stated by Thorn and associates to be unlike that previously recorded as following the administration of serum, plasma or acacia and unlike the spontaneous diuresis of the nephrotic state. The latter two diureses persist long after the period of therapy. With albumin, on the other hand, the diuresis was stated to proceed at a constant rate during the period of administration and to stop at the end of it. Careful scrutiny of the seven patients presented by Thorn reveals that only two of them had anasarca and in these two, on one occasion, the diuresis persisted for at least several days after the albumin was discontinued and in the other the diuresis stopped during the administration of albumin. It is evident, therefore, that more data are needed before it can be satisfactorily concluded that "the diuresis following albumin proceeds at a constant rate during the period of administration only and stops at the end of it." Thorn and associates point out that albumin administration in the presence of severe hypertension and nitrogen retention and the absence of edema appears contraindicated, owing to the danger of overloading the cardiovascular system. They also point out their study does not indicate that the diuresis, when induced by albumin, results in any change in the natural history of the disease process. No deleterious changes in renal function as a result of the large doses of albumin were observed. It is obvious that much more work is needed to decide whether the beneficial effects produced by human albumin in nephrotic anasarca are great enough to justify the cost of 50 grams a day over long periods of time.

HEMOSTASIS AND THE HEMORRHAGIC DISEASES

L. M. TOCANTINS, M.D.

NOUVELLES ÉTUDES SUR L'HÉMOPHILE; RÔLE DES ALBUMINES PLASMIQUES DANS LA FORMATION DE LA THROMBINE. Feissly, R. Helvet. med. acta 11: 177-88, 1944.

The author studied the role of hemophilic plasma albumin in the formation of thrombin. The albumin and other plasma fractions were obtained from platelet-free plasma by precipitations with ammonium
sulfate, acidification with dilute sulfuric acid, followed by dialysis. The albumin fraction isolated from normal plasma added to a solution of normal globulin does not exert any delaying effect on the speed of thrombin formation. The albumin fraction isolated from hemophilic plasma added to a solution of normal globulin delays by several hours the time of the appearance of thrombin. This inhibiting property of the albumin fraction is destroyed by heat (67°C), is manifested before the formation of thrombin but has no effect on thrombin after it is formed.

In view of the above findings the author has modified his previous stand (Helvet. med. acta 8: 813, 1941) that in hemophilia the fundamental defect is a deficiency of the activator of prothrombin contained in the 'viscous protein' fraction of the plasma associated with the globulins. The stability of hemophilic plasma is now attributed by the author to a neutralization of the clot-accelerating globulins by inhibitors in the albumin fraction. The inhibiting effect of albumin may be overcome by the prothrombin fraction of the plasma, but not by the fraction containing only the prothrombin activator. These last observations may also be interpreted as showing that, though in the presence of enough prothrombin, clotting will eventually take place in spite of the albumin inhibitor, the clot-accelerating effect of prothrombin-free 'plasma thromboplastin' is reduced or overcome by hemophilic plasma albumins.

STABILITÉ DE LA PROTHROMBINE DANS LE SANG CONSERVÉ. Lavergne, G. H., and Lavergne-Poindessault, B.


The authors have attempted to account for the striking lack of agreement between prothrombin determinations by the one-stage and two-stage methods when carried out on aged citrated (or oxalated) plasma. Whereas, by the one-stage method, 14 hour old plasma kept at 0°C. will show a diminution of prothrombin of about 50 per cent, no significant decrease is observed in eight days, under the same conditions, when prothrombin is estimated by the two-stage method. One important difference between the two techniques is that in the two-stage method, a purified fibrinogen solution is used, while in the one-stage method the fibrinogen of the aged plasma itself is employed. The disagreement between the two techniques seems due to the fact that in aged plasma, denaturing of fibrinogen is rapid and this affects its rate of transformation to fibrin by thrombin. The authors conclude that: (a) the one-stage method should be used only in fresh plasma; (b) it is not suitable for measuring prothrombin of aged plasma because the denatured fibrinogen falsifies the result (indeed, a naturally resistant fibrinogen may produce the same effect); (c) prothrombin is stable in citrated blood for eight days at 0°C. and such blood is as suitable for transfusions as fresh blood in so far as prothrombin is concerned.

The authors’ demonstration that fibrinogen was the deficient factor was brought about by mixing prothrombin-free Al(OH)₂ adsorbed plasma with aged plasma. Such mixtures lead to a normal prothrombin time (allowing for the factor of dilution) by the one-stage method. The explanation seems to be that normal reacting fibrinogen is supplied by the prothrombin-free adsorbed plasma, while prothrombin as such is supplied in normal amounts by the aged plasma. Variations in the conversion rate of fibrinogen seem, therefore, like variations in the prothrombin conversion rate, to contribute to the lack of agreement occasionally observed between results obtained by the two methods. Other implications of these experiments are apparent. According to Quick the loss of prothrombin activity in aged plasma is due to destruction of 'component A' of the prothrombin complex, while in Al(OH)₂ and dicoumarinized plasma 'component B' is absent. If the observations of the French workers are confirmed, they would tend to indicate that 'component A' is simply fibrinogen undenatured by standing.

HEMATOPOIETIC TISSUES

O. P. JONES, Ph.D.


During an investigation of the divisional capacity of maturing human erythroblasts it was found that preparations stained for centrosomes and centrioles were also suitable for demonstrating midbodies. The present paper reports observations made on dividing megaloblasts in two marrows obtained from pernicious anemia patients during relapse. Midbodies first make their appearance in late anaphase before the first signs of cellular constriction but in the path of the future divisional furrow. They are, however, finally excluded from the daughter cells, which is evidence opposing the view that they are related to
centriole formation. These studies show that megaloblasts do not differ from other animal cells with respect to their midbody formation. This is of great interest, since megaloblasts are abnormal in several other respects.


By studying the cellular content of tissue fluid (peritoneal) and peripheral lymph from the diaphragmatic plexus, several problems pertaining to the lymphocyte have been attacked. It was found that there are approximately five times as many leukocytes in tissue fluid as in lymph. This may be due to the fact that the lymphocyte is the most common cell in tissue fluid. The evidence presented indicates that motile and nonmotile bodies have the same absorptive ratios, which supports the author's contention that the mechanics of lymphatic absorption is intercellular rather than intracellular. Suspensions of marrow cells pass through the endothelium in about the same proportion to their concentration. Assuming that the properties of lymphatic endothelium and the reticulo-endothelium are identical in all respects, the author suggests that these experiments offer a uniform theory for the delivery of blood cells to the circulation. However, it should be pointed out that most histologic and hematologic evidence has not supported this view.


The ultracentrifugation of rat erythrocytes demonstrated that they contain three substances differing in specific gravity and perhaps physicochemically (Beams and Hines: Anat. Rec. 98: 155, 1944). In the present paper, similar experiments have been made with Necturus and frog erythrocytes. When ultracentrifugal forces from 10,000 to 400,000 times gravity were employed for periods of from 5 to 30 minutes, the amphibian erythrocytes demonstrated a remarkable degree of elasticity by returning from a distorted shape to a normal one. Hemolysis did not occur when erythrocytes were fragmented, indicating that the cells have more structure than a fluid bladder. Fragments of amphibian erythrocytes tended to round up instead of returning to or maintaining a flattened shape. This seems to indicate that ultracentrifugation alters their viscosity and membrane properties. Ultracentrifugation of amphibian erythrocytes produced a stratification not unlike that reported for the mammalian corpuscle.


Functions of the several leukocytes have been determined from time to time by subjecting them to various experimental conditions. The present article is unique in that it was possible to study three different leukocytes while they participated in more or less related phenomena—the growth and regression of amphibian eggs. Lymphocytes were attracted to the healthy egg, engulfed and finally assimilated. Hence, lymphocytes add to the substance of the growing egg and in this respect act as trephocytes. Neutrophils invade the egg shortly after it shows the first signs of degeneration and break up the yolk into fragments. After phagocytizing much of this material, the neutrophils undergo a necrosis and finally die. The remaining traces of the corpus atreticum are removed by follicle cells and macrophages (transformed lymphocytes). Eosinophils were the only leukocyte found in the small, yolkless, atretic ova. The distinct and deeply eosinophilic specific granules of these cells coalesce into a homogeneous mass after they have invaded the egg. This homogeneous material is finally liberated into the cytoplasm and aids in the formation of channels. These studies indicate that the catabolic activities of the neutrophil and eosinophil are quite dissimilar.


In recent years, the work of the Yale group and others concerning the cellular source of antibodies has attracted considerable attention (J. A. M. A. 128: 1232 [Aug. 15] 1945). The present paper is the result of an extension of these studies to the field of hormonal control of the release of serum globulin from lymphocytes. Adrenotrophic hormone, adrenal cortical extract, compounds E and F, corticosterone, desoxycorticosterone acetate, prolactin and human serum gamma globulin were administered to groups
of normal and adrenalectomized mice and normal rabbits. Marked changes were observed in the lymphoid tissue of these animals as early as one hour following the injection of a single dose of adrenotropic hormone or adrenal cortical extracts. Histological changes were divided into three types: degenerative changes, repair changes and recovery changes. These histological alterations were correlated with certain physiological roles of the lymphocytes. Evidence is presented which indicates that the action of adrenotropic hormone on lymphoid tissue is mediated by the adrenal cortex. Since several unrelated stimuli may increase pituitary-adrenal cortical secretion, these probably account for the so-called 'accidental involution' of lymphoid tissue. The mechanism by which lymphocytes contribute serum gamma globulin to the blood in normal animals and antibody protein in immunized animals is a dissolution of lymphoid tissue.


The presence of lymphatic tissue and accumulations of lymphocytes in the major salivary glands has been recognized for a long time. However, little or no attention has been given to similar structures within the minor salivary glands. The present paper deals with a study of 33 series of the larynx of the cat. These were fixed in Bouin's fluid, Zenker's fluid, Helly's or Maximow's Zenker-formol and stained with either hematoxylin and eosin, Mallory's connective tissue stain, or methylene azure-phloxine neutral stain. The particular glands studied were: (1) mucous glands of the root of the tongue; (2) epiglottic and subepiglottic laryngeal glands; (3) the tracheo-laryngeal glands of the lower larynx, and in the soft palate (4) the palatine (salivary glands); (5) the nasopharyngeal glands and finally (6) the glands of the laryngo-pharynx. The small and usually atypical lymphatic nodules sometimes had clear areas which seemed to be equivalent to proliferative centers. Cells associated with the lymphatic tissue were small lymphocytes (lymphocytoid cells), blastic cells and large blastic cells. To the reviewer, it seems unfortunate that the latter cells were so designated, since it implies that leukemic cells are normally present in this tissue. Two types of polymorphonuclear cells were encountered. The first was found within duct lumen and seemed to represent derivatives of lymphocytoid cells which were to degenerate ultimately. The second type of polymorphonuclear cell had a nuclear pattern quite similar to that of the blood neutrophil but lacked cytoplasmic granules. Since these were usually found in areas of the soft palate where there was marked degeneration, it is thought that these cells arose locally in response to some inflammatory process.


The presence of lymphocytes in the gastrointestinal epithelium has been subjected to many and diverse interpretations as to their exact morphology, location and function. For example, they have been considered to be normal and degenerate, intercellular and intracellular, mitotic and nonmitotic, and finally migrating toward the lumen and not migrating to the lumen. Material for the present study was obtained from 10 mice of the C57 Black strain. Longitudinal sections were made through the pyloric portion of the stomach and duodenum. An examination of 100 epithelial cells in the crypts of Lieberkuhn and on the villi of each of the 10 animals revealed that most of the lymphocytes are intracellular. These lymphocytes undergo degenerative changes as they pass from the basal layer toward the lumen. Mitotic figures, both normal and abnormal, are limited almost exclusively to the crypts of Lieberkuhn. The appearance and behavior of lymphocytes in the epithelial cells of the gastrointestinal tract are similar to those seen in secondary lymphatic nodules. It has been hypothesized that the activity of these lymphocytes may be in the nature of a defense reaction.


If hematological investigations require the determination of the presence or absence of cell types, then the dry smear, imprint or section technic applied to small samples may be used advantageously. But, if it is desired to obtain information relative to the distribution of cell types throughout the entire marrow, this problem is attended with many technical difficulties, especially when small laboratory...
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The authors obviated these difficulties by using suitably grooved wooden blocks to hold the femora while removing the epiphyses and corticalis with a "Moto Tool" prior to fixation. After fixation more of the corticalis is ground off and the pencil of marrow removed. Small cheesecloth bags are used to carry the marrow pencils through various phases of paraffin embedding. This new technique for obtaining marrow pencils may be employed to extend knowledge regarding the variation of megakaryocytes under certain conditions; the equilibrium between hematopoietic tissue, fatty tissue and sinuses, and the delivery of myeloid cells into the circulating blood.


Studies on the manner of locomotion of blood and tissue cells in vitro led Rich, Wintrobe and Lewis (Bull. Johns Hopkins Hosp. 47: 351, 1939) to conclude that myeloblasts, lymphoblasts and mononuclear phagocytes were unrelated. The present study was undertaken to consider the relationship between lymphocytes and monocytes in tissue culture, since the above observations were in disagreement with the unitarian theory of hematopoiesis. De Bruyn cultured abdominal lymph nodes from rabbits and recorded the locomotion of cells with time-lapse photographs on reversible film at the rate of 60 per minute. Sixteen series of 25 to 35 cultures each were studied after 3, 8, 16, 33 and 52 hours' incubation. In the early cultures lymphocytes migrate in two phases. The first is an active locomotory phase in which the cell has an anterior pseudopodial area and a posterior tail-like projection. Such cells are said to be polarized. The second phase is a nonlocomotory phase in which the pseudopodial area and tail are withdrawn—or depolarized. Although such a state has been called a "rest period," small pseudopodia are continually arising. When lymphocytes hypertrophy they tend to shorten their locomotion phases. Macrophages in the older cultures were continually in the depolarized phase. A genetic relationship was established between these cells on the basis of gradual transitional stages in the mode of migration between the typical lymphocyte and the hypertrophied lymphocyte, and between the latter and macrophages.

THE SPLEEN

S. ESTREN, M.D.


This report concerns a patient who had been splenectomized for traumatic rupture of the spleen six years before he came under the supervision of the author. An abdominal operation for an unrelated cause revealed a tumor in the midjejunal serosa, and several similar tumors along the greater curvature of the stomach, the lower margin of the transverse colon, and in the greater omentum. Microscopically all of these tumors were hyperplastic hemolymph nodes which had taken on the characteristics of splenic tissue (except for absence of the trabeculae). One large mass was definitely an accessory spleen. According to Rhame, these changes resulted from the removal of the spleen in a young adult, and were an attempt to restore the function of the spleen by hypertrophy of existing hemolymph nodes and accessory splenic tissue. It parallels occasional reports of the presence of multiple splenic nodules throughout the peritoneal cavity after trauma to the abdominal wall.


These three articles report one case each of chronic idiopathic neutropenia cured by splenectomy. The symptoms included listlessness, weakness, repeated infection, and splenomegaly. The cases are further examples of the entity first described by Wiseman and Doan in 1939, which is being recognized with increasing frequency. The case of Rogers and Hall showed, in addition to a neutropenia, moderate anemia and thrombocytopenia, and clinical and biopsy evidence of hepatitis. It illustrates, therefore, a pancytopenia or panhematopenia, rather than a pure neutropenia. It is possible that the hepatitis was associated with chronic splenic dysfunction since liver function became normal after splenectomy.
No definite statements as to pathogenesis appear in these reports. The bone marrow was consistently normal. In the first report, the spleen showed no evidence for "segregation" or phagocytosis of white cells. This was also true in the second case. In case 3, on the other hand, granulocytes were numerous in the splenic capillaries, and phagocytosis of polymorphonuclears was noted. The question of excessive destruction of granulocytes by the spleen, in contrast to their nonliberation from the bone marrow as a result of suppressing effect of the spleen, is yet to be settled.

The basis for the disease, according to the writers, is splenic inhibition of the bone marrow, resulting in a disturbance not only in the production of cells in the marrow, but also in their liberation into the blood stream. This inhibitory action may evidence itself only on one particular type of cell (giving neutropenia, anemia, or thrombocytopenia) or on two or more types of cells. When all three types are affected, pancytopenia results. Splenectomy cures all these conditions by eliminating the inhibitory factor.

The author describes a crystalline substance which he has isolated from the spleen of guinea-pigs and which he designates "splenin." In guinea-pigs, this substance was found to have three actions: (1) it reduced bleeding time; (2) it increased capillary resistance; (3) it inhibited the release of histamine from blood cells. Studies were done in normal, hypophysectomized, adrenalectomized, and splenectomized guinea-pigs. In each type of animal, the bleeding time was studied after injury, hemorrhage, starvation, and the use of certain drugs. Splenectomized guinea-pigs showed increased bleeding time after injury: this could be returned to normal by use of splenin. A "pituitary-adrenal reaction to stress" is described, which was inhibited by splenectomy, and returned to normal by splenin. Extracts of pituitary, adrenal, and spleen had similar actions in this regard, and splenectomy inhibited the action of each type of extract. Other organ-extracts (liver, kidney, nodes, et al.) had no effect.

The author considers his experiments to prove that the spleen behaves as an endocrine organ and participates with other endocrine organs, notably the pituitary and adrenal, in a combined reaction to certain stimuli. The author does not reveal the method by which he extracted "splenin," and thus makes impossible duplication of his results. The isolation of a crystalline hormone from the spleen would be of great importance in further evaluation of splenic physiology, but further work is necessary before this goal is reached. The value of a specific substance that would reduce bleeding time is also obvious. If verified, this work would be one of the first direct proofs of the endocrine nature of the spleen.


This is one of the first available articles on hematology from France in the past few years. The authors defend the concept of a "splenic anemia" as an entity parallel to "splenic pancytopenia" and to idiopathic thrombocytopenic purpura ("splenic thrombocytopenia"). They separate from the wastebasket "splenic anemia," a few distinctive cases of nonhemolytic anemia associated with splenomegaly and cured by splenectomy. They distinguish this entity from hemolytic anemias, "Banti's disease," etc. One case is presented in detail, and several others are mentioned.

Severe Type of Hereditary Anemia with Elliptocytosis. Interesting Sequence of Splenectomy.


Three types of "heredo-familial" anemia which do not respond to iron are well known. These are congenital spherocytic hemolytic anemia, Mediterranean anemia, and sickle-cell anemia. The latter two are hypochromic anemias, yet they do not respond to iron therapy. Cooley describes, in the present report, a new form of heredo-familial anemia which is hypochromic in type, which does not respond to iron therapy, and whose characteristic cell is an elliptocyte. Nineteen of 19 boys in the mother's line of descent had severe anemia; 16 of these died, one recovered spontaneously, and two are the patients studied by Cooley. No girls were affected. The systemic nature of the disorder is suggested by the stunting of one boy's growth, and the progressive character of the anemia. There was no evidence for a he-
molytic process. Splenectomy was done because of the lack of effect of other modes of therapy, and resulted in slow steady improvement of moderate degree.

Cooley suggests that his patients represent a new group of anemias due either to a defect in the red blood cell, or to an inability to utilize more than some maximum amount of iron. This same defect has been postulated to explain Mediterranean (target cell) and sickle-cell diseases, and it seems reasonable to group these new cases with them, despite the absence of a hemolytic component. The effect of splenectomy was definite although not dramatic. The further course of the patient should be of interest.


This report concerns three cases of hypochromic anemia which did not respond to iron or iron-liver medication. Splenectomy was performed because of progression of the disease. The first two cases died after splenectomy; the third case showed no essential hematologic or clinical change after splenectomy. In all three cases post-splenectomy blood smears showed small iron-staining coccoid or bacilloid bodies in the red cells, which resembled Bartonella bodies. Cultures and animal inoculations, however, failed to demonstrate Bartonella organisms. It was concluded that the bodies were iron-containing granules of obscure significance, resembling similar bodies described by Grünberg in certain animals.

Refractory hypochromic anemias form a heterogeneous group of disorders from which various entities are being segregated. Mediterranean disease and sickle-cell disease are two such entities. Cooley’s patients (described above) may represent a third one, and the three cases of the present report may represent still another. The intra-erythrocyte bodies are probably of significance, although similar ones have occurred after splenectomy for other diseases (Grünberg).


In a three-month period in 1943, the authors saw 18 cases of infectious mononucleosis in one army hospital, of which one was complicated by rupture of the spleen. Rupture occurred on the 14th day of the patient’s illness, and was characterized by a sudden sharp pain at the left upper abdomen and left shoulder tip, the appearance of surgical shock, and the disappearance of the previously palpable spleen. A wide longitudinal split of the splenic capsule was found at operation, and there were two other tears in the splenic pulp. Splenectomy was curative.


A soldier, aged 28, had had a single attack of vivax malaria overseas. Eleven months later, while in the United States, he had a sudden chill and fever, plus acute pain in the left shoulder and left upper abdomen. There was no shock. Operation revealed a ruptured spleen with an abdomen full of fresh and old blood. Splenectomy was curative. Nine days later, plasmodium vivax was recovered from the blood during another chill.


A soldier, aged 28, had his first attack of malaria two weeks after his return to the United States from the South Pacific, where he had taken atabrine daily and not had malaria. There were several more attacks in the following ten months. At this time, another attack occurred. One day after its onset, the patient suddenly developed chill, vomiting, numbness of the legs, abdominal pain, blindness, surgical shock, and died within 24 hours. Autopsy revealed multiple lacerations of a very soft spleen, and an abdomen full of blood.

The question of slight trauma is considered by the authors. The patient had a good deal of vomiting and straining during his attacks. It is suggested that abdominal palpation and excessive coughing, vomiting, and straining may perhaps be related to rupture of a spleen which is already softened by malaria or, perhaps, other inflammation.
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A young woman was suddenly seized with upper abdominal pain, inability to take a deep breath, and fainting. Examination resulted in the diagnosis of 'active intraperitoneal bleeding, probably secondary to ectopic pregnancy.' The only finding at exploration was a soft spleen with a rent near the upper pole. Splenectomy was curative. The spleen weighed 340 grams and showed multiple lacerations, but no cause for the rupture was demonstrable.

Rupture of a normal spleen is a rare occurrence. The fact that this spleen was 'soft' may have contributed to its rupture. Specific diagnosis is not to be expected in such cases, but splenic rupture may have to be considered in intraperitoneal bleeding from unknown cause.


The authors report a Navy officer who complained of sudden abdominal pain which was followed by shock, distention, and death. Autopsy revealed a perforated aneurysm of the splenic artery just proximal to the gastro-epiploic branch. No clue as to etiology could be obtained. The spleen itself was normal. The vascular system was otherwise normal. There were no signs of lues.


The author reviews the 157 recorded cases of primary splenic neoplasms in the literature, and adds seven of his own. He recognizes seven types: (1) angiomata, both hemangiomata and lymphangioma; (2) lymphoma; (3) reticulo-endothelial tumors, including enderthelioma and reticulum-cell sarcoma; (4) embryonic inclusions, including epithelial cysts, dermoids, and mesothelial cysts; (5) fibrosarcoma; (6) leiomyosarcoma; (7) neurosarcoma. The latter tumor is theoretical only, as no examples have yet been reported. The listing is in descending order of frequency.

Of the seven new cases, the chief complaint of the patients was the presence of an abdominal mass. In one case, there were signs of a ruptured viscus. In two cases, the splenic tumor was an incidental finding at autopsy.


This report concerns an 18 year old naval student with a calcified cyst of the spleen. His symptoms were of three months' duration, and included abdominal pain, paresthesiae of the fingers, and pain in the left lower chest. Examination showed limited excursion of the left diaphragm, and moderate left upper quadrant tenderness. A calcified mass in the left upper abdomen was discovered on x-ray and was shown not to be connected with the gastrointestinal tract or the kidneys. A splenectomy was done, and the spleen showed an irregular, partially calcified cyst in the upper pole. The patient's symptoms were completely relieved.

Only 7 calcified cysts of the spleen had been reported 1943, and only 152 splenic cysts of all types by 1941. As a rule, cysts produce no symptoms. Occasionally, the patient finds a mass in the left upper quadrants. The x-ray demonstration of annular calcification is practically pathognomonic, although rarely an aneurysm of the splenic artery may be partially calcified.


This is another report of a relatively rare splenic disease with splenomegaly. A young woman with anorexia, malaise, weight loss, cough, chills, and fever was found to have signs of consolidation at the left lower chest, and a large spleen. Examination of the sputum revealed tubercle bacilli, but the hooks of tenia echinococcus were easily found. An abdominal operation was performed at which a large multiloculated cyst was found replacing the spleen. It was adherent to the left diaphragm, and had apparently ruptured into the left chest. Formalization and marsupialization were performed, with excellent recovery. At a nonrelated abdominal operation almost three years later, the only sign of a spleen was a fibrous thickening at the left subphrenic region. The chest was normal.

In all these reports of splenic 'tumors,' relatively few laboratory data are given by which one might ascertain their effect on the blood elements.