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Causes and Cures of Oral Bleeding

E. Cheraskin

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Causes and Cures of Oral Bleeding

E. Cheraskin

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ORAL BLEEDING is still one of the big problems in the dental office. This is so for two reasons. In the first place, oral bleeding may be serious and even fatal. More important, however, is the fact that, even though the oral bleeding is controlled simply, the problem is not entirely solved, because the causes of hemorrhage may still be present and be producing other symptoms and signs. The very same cause which led to the bleeding might well have been the reason for the extraction, the prophylaxis or the gingivectomy. Therefore, the basic problem has actually remained unsolved.

A practical understanding of the control of bleeding requires: (1) a clear-cut definition of *hemorrhage,* (2) a rational appreciation of the *normal mechanism of hemostasis,* (3) knowledge of the many and varied *hemostatic agents and measures* and (4) the *diagnostic armamentarium* for the detection of the bleeding tendency.

DEFINITION OF HEMORRHAGE

Hemorrhage becomes clinically apparent when blood escapes from a vessel. Obviously, the severity of the hemorrhage is related directly to the size of the vessel and to the duration of the bleeding period. For example, hemorrhage from the aorta is always very grave and almost always fatal. However, the big stomatologic problem is the capillary and metarteriolar bleeding that follows an injury which, under normal circumstances, would not result in

undue bleeding. This sequence of events is commonly observed after the extraction of a tooth, during or following a prophylaxis or gingivectomy or with toothbrushing; or the hemorrhage may seemingly be unrelated to any form of intraoral trauma.

MECHANISM OF HEMOSTASIS

The physiologic control of bleeding is a complex and dynamic process. Therefore, it is impossible to describe it in two dimensions. However, for descriptive purposes only, it will be dissected into phases.

PHASE 1.—In order to produce bleeding, there must always be an

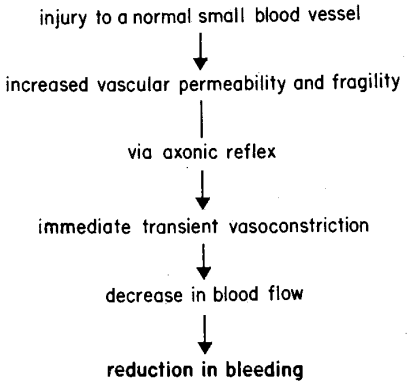

FIG. 1.

injury. Sometimes the trauma is very obvious; in other cases, it may be quite obscure. Nonetheless, an injury to a small blood vessel leads to increased permeability and fragility (Fig. 1). Almost immediately following the injury, there is reflex smooth muscle contraction in the vessel wall (Chen and Tsai, 1948). With a reduction in the caliber of the damaged vessel, blood flow diminishes and may even cease completely. Obviously, should such vasoconstriction not take place, there is the possibility of excess bleeding.

Unfortunately, it is impossible to determine a disturbance in this mechanism from the history, the clinical examination or laboratory tests. Therefore, little mention is ordinarily made of the role of this mechanism in the production of pathologic bleeding.

PHASE 2.—With a decrease in blood flow due to vasoconstriction as a result of the axonic reflex, the platelets which normally flow

through the center (the faster portion) of the blood stream, now migrate toward the periphery of the vessel (Fig. 2). At this point they strike up against the vessel wall at the site of injury and agglutinate. The end result is a mechanical plug at the rupture

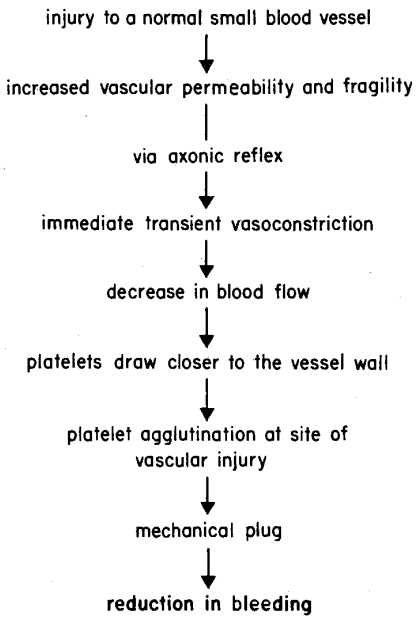

FIG. 2.

site of the vessel wall. This, of course, contributes to the reduction in bleeding.

PHASE 3.—The escaping platelets stick together (Stefanini, 1954) and liberate a *platelet vasoconstrictor agent* which has been variously designated as *thrombocytin, thrombotonin* and *serotonin* (Bigelow, 1954). The vasoconstrictor substance tends to constrict the regional vessels even more than the vasoconstriction which was the result of axonic reflex action (Fig. 3). The end result is a decrease in blood flow and further reduction in bleeding (Zucker, 1947).

Vascular factors in physiologic hemostasis.—The one common denominator which characterizes the three phases in physiologic hemostasis just described is that all of the mechanisms operate by

means of changes in the vessel wall (Fig. 4). These are collectively referred to as *vascular factors* in physiologic hemostasis.

PHASE 4.—The escaping blood creates an extravascular force.

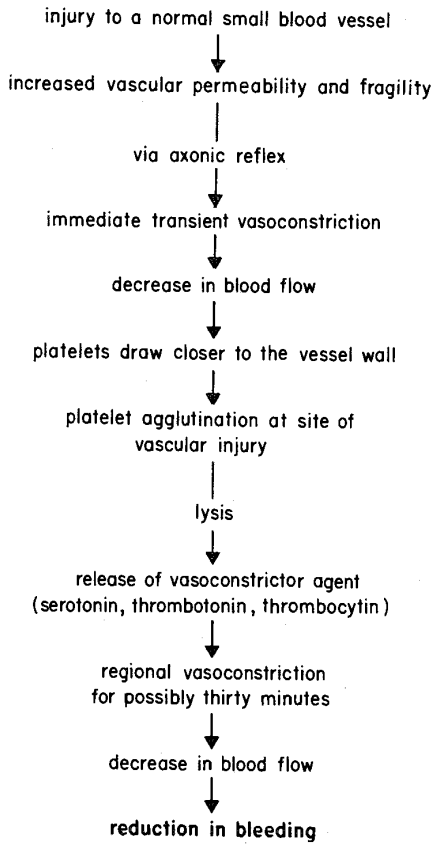

FIG. 3.

This pressure plus that which normally prevails in the tissues produces an even greater pressure against the small regional vessels (Fig. 5). Such a force tends further to compress the blood vessels, leading to reduction in the caliber of the vascular lumen, even greater slowing of the blood flow and a further diminution of hemorrhage. Obviously, this particular phase of hemostasis is not

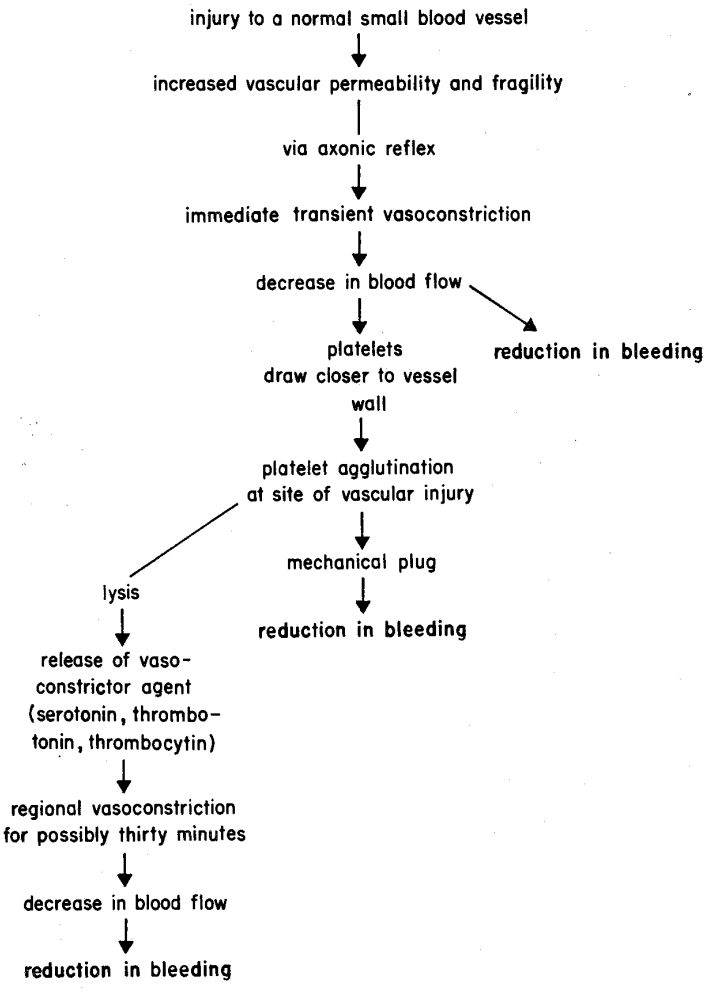

FIG. 4.—Vascular factors in physiologic hemostasis.

so important following the extraction of a tooth as it is in other types of oral bleeding.

Extravascular factors in physiologic hemostasis.—Phase 4 in physiologic hemostasis is referred to as *extravascular factors.*

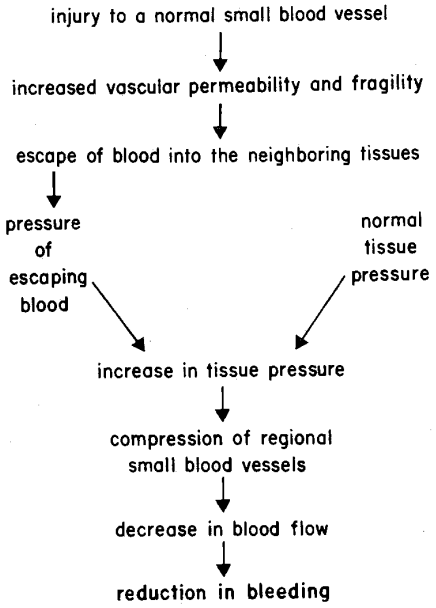

FIG. 5.—The extravascular factor in physiologic hemostasis.

PHASE 5.—The escaping blood, it should be recalled, contains platelets and plasma, and so the interplay of the thrombocytes and some of the plasma fractions represents the next step in hemostasis (Fig. 6). It is clear that there is, within plasma, *antihemophilic globulin,* also termed AHG (Lewis *et al.,* 1946); *plasma thromboplastin component,* abbreviated PTC (Aggeler *et al.,* 1952); and a possible *plasma thromboplastin antecedent,* referred to also as PTA (Rosenthal *et al.,* 1953).

The platelets, which, as already noted, clump and disintegrate, release an enzyme referred to as *thromboplastinogenase* which reacts with the antihemophilic globulin, plasma thromboplastin component and plasma thromboplastin antecedent to form the highly necessary *thromboplastin.*

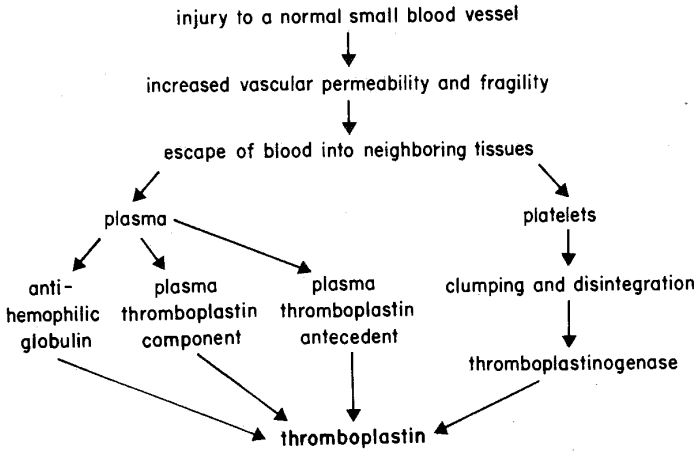

FIG. 6.

PHASE 6.—The plasma contains a number of other fractions of importance in hemostasis. For example, there is the *stable factor* (de Nicola, 1953), a *labile factor* (Brennan *et al.*, 1952) and calcium. Figure 7 demonstrates that the interaction of the stable and labile factors with calcium and already formed thromboplastin

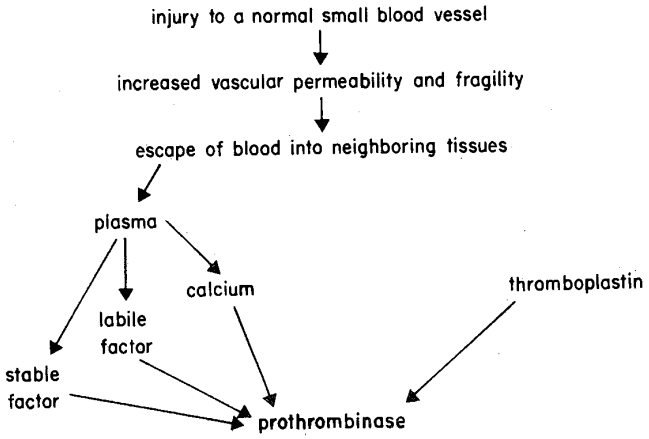

FIG. 7.

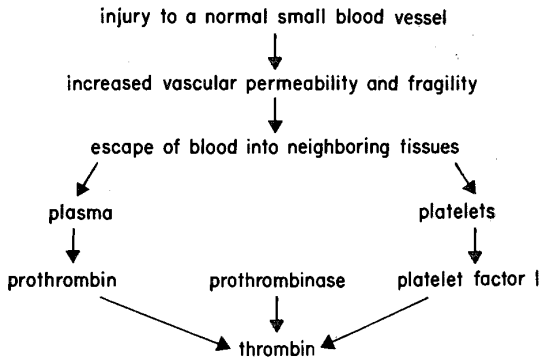

FIG. 8.

produce *prothrombinase*. This enzyme is very necessary for the production of thrombin, as will be described in the next section.

PHASE 7.—The enzyme prothrombinase acts on prothrombin with the help of *platelet factor 1*, so that the end result is the freeing of *thrombin* from *prothrombin* (Fantl and Nance, 1948). These relationships are schematically outlined in Figure 8.

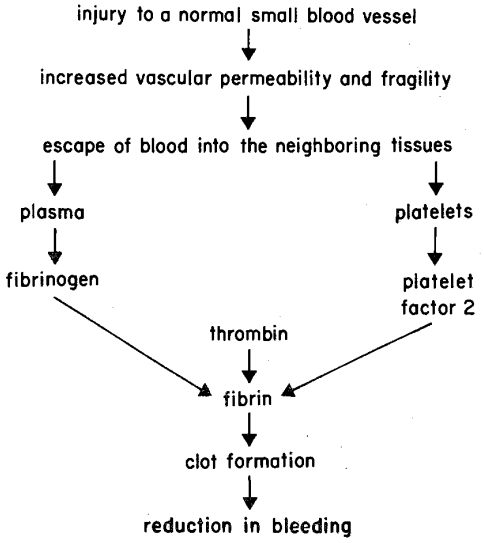

FIG. 9.

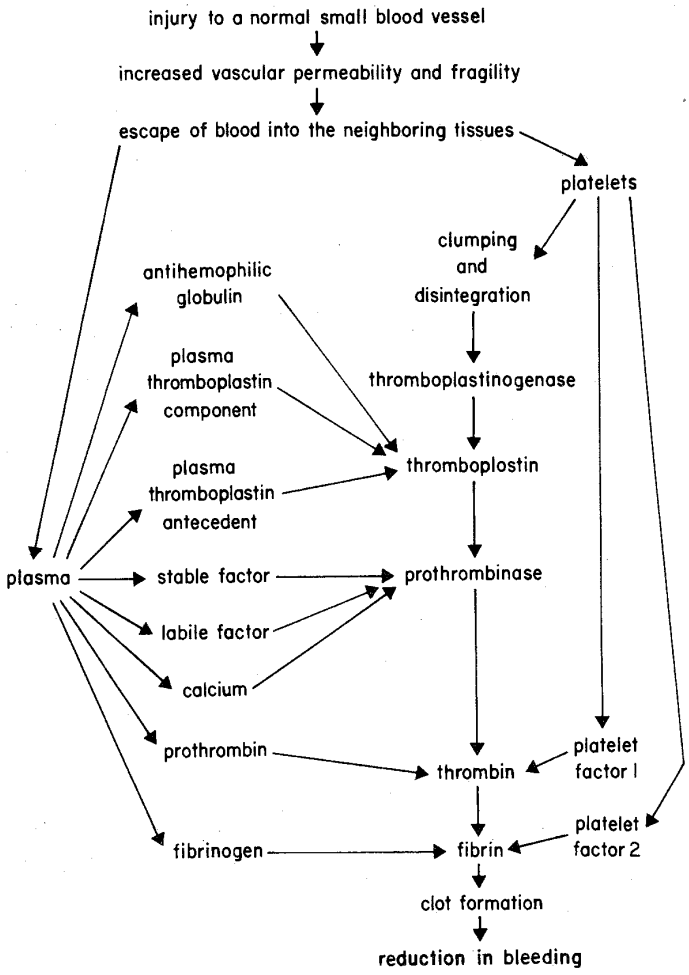

FIG. 10.—Intravascular factors in physiologic hemostasis.

PHASE 8.—Finally, the interaction of *prothrombin* and *fibrinogen* and the accelerating effect of *platelet factor 2* yields fibrin (Eagle, 1935). The end result is clot formation (Fig. 9).

The sequence of events (not shown in these charts) is then clot retraction, possibly some degree of clot lysis, organization of the clot and, finally, vascular recanalization.

Intravascular factors in physiologic hemostasis.—The one common denominator which characterizes the preceding three phases in hemostasis is that all of the mechanisms operate by means of changes in one or more of the blood constituents (Fig. 10). These mechanisms are collectively referred to as *intravascular factors* in physiologic hemostasis.

DISTURBANCES IN THE HEMOSTATIC MECHANISM

It should be emphasized that the hemostatic process which has just been outlined is oversimplified. Much more is known about the mechanism than is here described, and even more of the process requires clarification. However, it becomes abundantly clear, from a composite of the accompanying charts, that the control of bleeding rests with the synchronized interplay of three factors: (1) *extravascular,* (2) *vascular* and (3) *intravascular* (Fig. 11).

EXTRAVASCULAR FACTORS

The elasticity of the perivascular tissues serves two purposes: (1) it protects the vessels from trauma and (2) it resists or opposes the escape of blood from an injured blood vessel. Broadly speaking, bleeding due solely or almost exclusively to a disturbance in the extravascular mechanism is encountered in two different types of situations: (1) where vessels course close to the surface of the skin or mucosa and (2) in situations characterized by loss of perivascular elasticity.

Apropos to the first situation—that is, vascular superficiality—it is noteworthy that a blood vessel which courses close to the periphery lacks the support of neighboring tissues on its surface side. This is especially true when the blood vessel is directed parallel to the surface. This point applies particularly to the oral mucosa because of its anatomic design and the fact that intraoral trauma is customarily high. With respect to the second situation, it is important to point out that in the aged and in those with serious debilitating disorders there is often marked loss of subcutaneous and submucosal elasticity. This combination of extravascular circumstances may, in

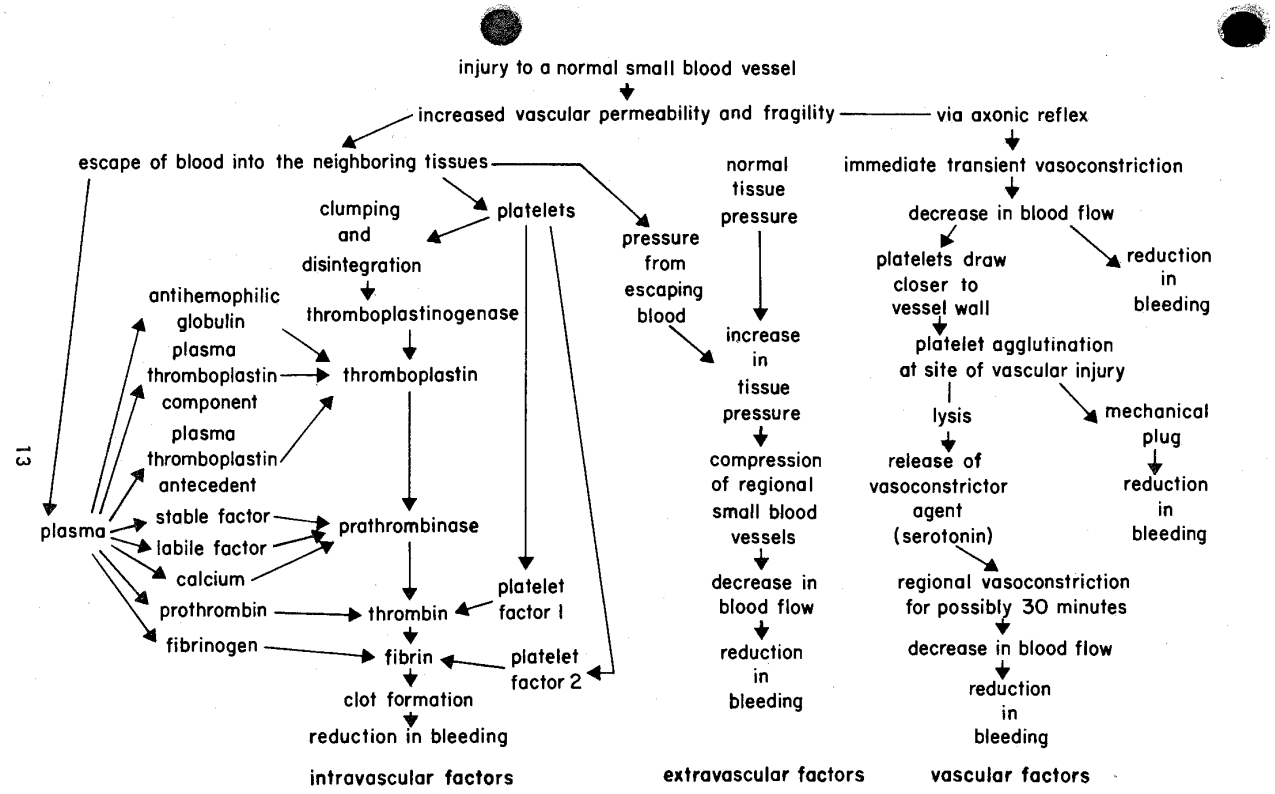

FIG. 11.

part, explain the ease with which bleeding occurs in some patients (Tocantins, 1947).

Vascular Factors

There are other situations in which the extravascular tissues are normal and the intravascular blood fractions are present in adequate amounts for purposes of physiologic hemostasis. But oral bleeding

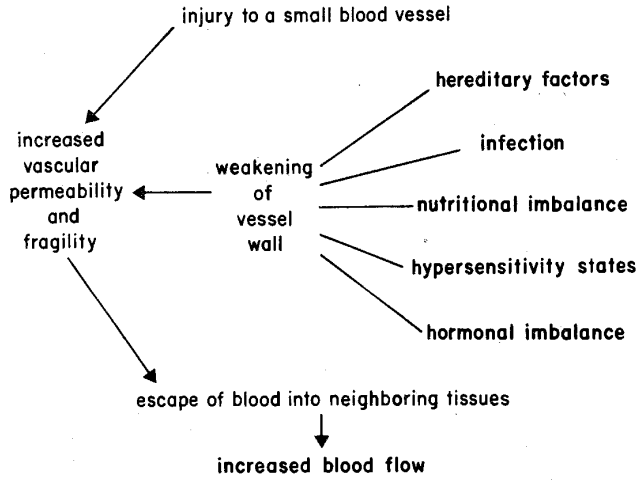

Fig. 12.—Factors which alter the vessel wall and invite bleeding.

may still be encountered (Fantl and Sawers, 1955). Generally, the difficulty can be traced to pathosis in the vessel wall itself (Spaet, 1952). Weakness of the capillary and metarteriolar wall is the common denominator. Precisely why there should be a fragile and more permeable vascular barrier is not always clear. However, among the known causes are: (1) *heredity,* (2) *infection,* (3) *nutrition,* (4) *hypersensitivity* and (5) *hormones* (Fig. 12).

Heredity.—There is evidence for the statement that vascular weakness may be a familial trait. This possibility is well supported by the clinical findings in *hereditary hemorrhagic telangiectasia* (Alban, 1941). Case reports with oral bleeding are available (Syrop, 1957), but no carefully executed experimental studies have been performed to demonstrate the relationship of hereditary capillary weakness and oral bleeding.

INFECTION.—Certainly, infection produces toxins which may exert a deleterious effect on the vascular wall. This mechanism is well demonstrated in the streptococcal invasion of scarlet fever and meningococcemia. For that matter, this pattern may be observed with any severe infection. It is very likely, although the problem has not been seriously studied, that the toxins of the streptococcus and other microbes in periodontal and periapical infection may, in a similar manner, weaken the surrounding vascular tissue. Precisely how important this problem is has yet to be tested under carefully controlled conditions.

NUTRITION.—Various nutrients play a vital role in vascular integrity. For example, ascorbic acid is easily linked with the deposition and maintenance of intercellular cement substance. There are numerous accounts in the literature (Schultzer, 1934) to show the role of ascorbic acid deficiency states in oral bleeding.

HYPERSENSITIVITY.—The hemorrhagic syndrome may take the form of an allergic response to a food, to a drug or possibly even to an invading micro-organism or its toxin (Ackroyd, 1953). In other words, the altered vascular permeability and fragility may signify an allergic response to micro-organisms in the dental or periodontal structures. The effect of allergy on hemorrhage is clearly shown in so-called *anaphylactoid* or *allergic purpura.* The stomatologic aspects of this problem have never been investigated under rigidly controlled experimental conditions.

HORMONES.—Evidence exists that hormones, notably those of the hypophysis (ACTH), the adrenal cortex and the gonads (particularly the estrogens) play a role in the maintenance of vascular integrity. This is shown, for example, by the observation that a significant number of women suffer with easy bruisability just before the menses—that is, at the time when estrogen levels are lowest.

INTRAVASCULAR FACTORS

Bleeding, because of intravascular pathosis, may be due to a deficiency in the quantity or quality of (1) *platelets,* (2) *prothrombin,* (3) *fibrinogen* or (4) any one or combination of a number of *other plasma fractions* previously mentioned. Thus, in the final analysis, bleeding due to a disturbance in intravascular factors manifests a derangement in one of three mechanisms, which are termed: (1) thromboplastin deficiency states, or *hypothromboplastinemia;* (2) prothrombin deficiency states, or *hypothrombinemia;* and (3) fibrinogen deficiency disorders, or *fibrinogenopenia* (Fig. 13).

HYPOTHROMBOPLASTINEMIA.—The role of thromboplastin in the coagulation mechanism has already been established. Its formation

is impeded by a deficiency of (1) platelets, (2) thromboplastinogenase, (3) antihemophilic globulin, (4) plasma thromboplastin component and (5) other less well-defined plasma constituents, such as plasma thromboplastin antecedent. In addition, a thromboplastin shortage may be the result of circulating anticoagulants which suppress the platelet and plasma elements so vital to the production of thromboplastin.

HYPOTHROMBINEMIA.—In the strictest sense of the word, all coagulation defects (even hypothromboplastinemia, and with the possible exception of the fibrinogen-fibrin link) are the result of defective production of thrombin. In its more limited sense, hypothrombinemia is the result of a deficiency of (1) *stable factor,* (2) *labile factor,* (3) *calcium* or (4) *prothrombin.* Calcium plays only a very minor role, since the coagulation mechanism is not disturbed until the calcium level reaches a 50% point—that is, a level below that for tetany (Stefanini and Quick, 1948).

FIBRINOGENOPENIA.—A reduction or absence of fibrinogen may be congenital or acquired. The congenital types are exceedingly rare. The acquired forms are associated with primary or secondary liver disease, and with these diseases fibrinogenopenia can occur and be of considerable clinical importance.

PREVALENCE OF THE HEMORRHAGIC DIATHESIS

The plaguing problem in the dental office is the individual who reports that he has a "bleeding" tendency or the patient who is recognized as a so-called "bleeder" during or after a dental operation. More puzzling and embarrassing is the situation when the laboratory reports a bleeding and clotting time within normal limits. The problem now is one of establishing the common cause or causes for oral hemorrhage.

Bleeding is most commonly the result of a defect in the vessel wall. In other words, the oral problems of a bleeding type are due to a disturbance in *vascular* factors. It is, therefore, quite comprehensible why most bleeders show normal bleeding and clotting times. This was shown quite dramatically in a research project at the Cleveland Clinic, where 527 patients with a chief complaint of hemorrhage were examined from a hematologic standpoint (Haden *et al.,* 1948). This study points up the fact that less than 1 in every 4 persons showed any significant intravascular defect. These studies, limited as they are, all suggest that bleeding is due principally to increased capillary permeability and fragility. Such observations are of cardinal interest, for it is a fact that the literature suggests that coagulation defects (e.g., hemophilia) are rare. Yet the bulk of

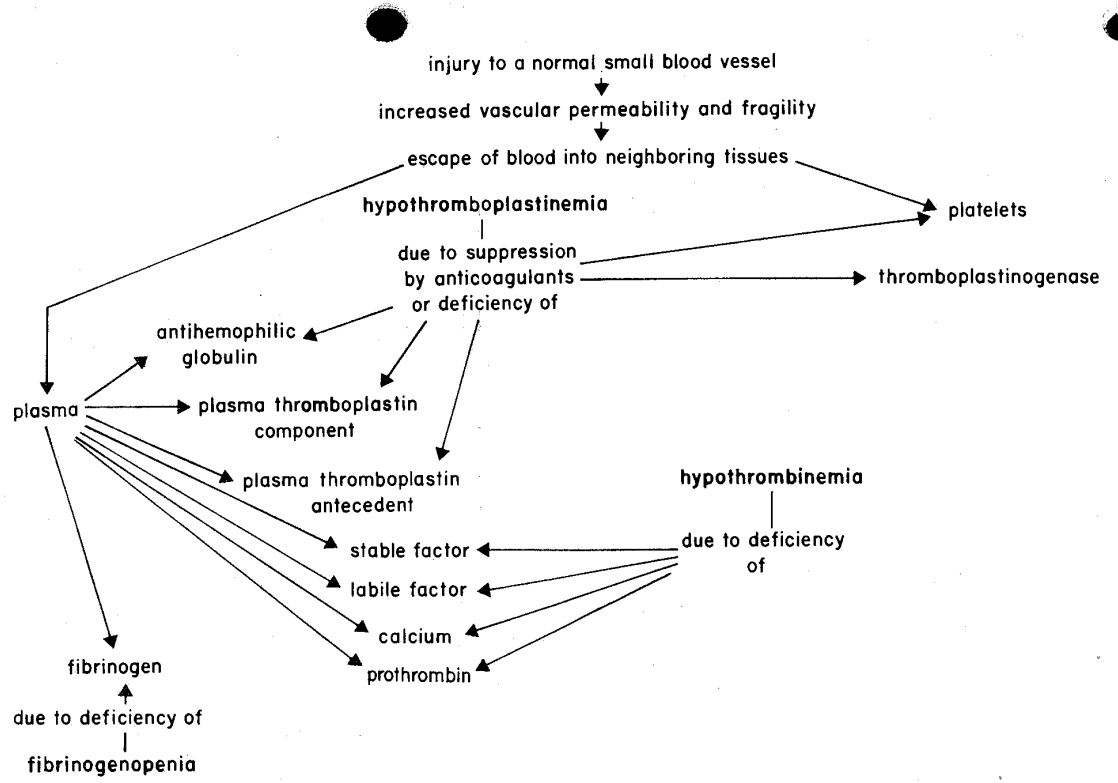

FIG. 13.—Intravascular factors which invite bleeding.

writing concerns itself with these same disorders. Conversely, whereas vascular pathosis is common, little attention has been given to it. This paradoxical situation stems from the fact that more investigative work has been done and more, therefore, is known about the *intravascular* mechanism, as contrasted with the *vascular* and *extravascular* processes. This, in turn, arises from the fact that more reliable tests are available for the study of the coagulation mechanism than for determining the status of the vessel wall.

CONTROL OF HEMORRHAGE

It should be clear from the description of physiologic hemostasis and the possible pathologic implications that the process is complex and that the control or lack of control of bleeding is the result of one, or usually, a combination of factors. Obviously then, it is difficult to imagine that there can be one or a small group of therapeutic measures capable of controlling *all* of the hemorrhagic problems encountered in the average dental office. Broadly speaking, the hemostatic armamentarium may be divided into two categories: (1) *local* and (2) *systemic* measures.

Local Measures

The measures which fall into this group include those agents and devices which can be applied directly to the bleeding part for the purpose of reducing or eliminating hemorrhage. These include: (1) *local pressure,* (2) *rest,* (3) *coagulation-promoting agents,* (4) *thermocautery,* (5) *application of ice,* (6) *local vasoconstrictors,* (7) *chemical escharotic agents,* (8) *antimicrobial agents* and (9) *sutures.*

Local pressure.—Direct pressure to a bleeding wound is a highly effective adjunct in the control of hemorrhage (Fig. 14). This is the procedure utilized following the extraction of a tooth when the patient is asked to bite down on a sponge. In part, here is the rationale for the use of periodontal packs. It should be pointed out, however, that direct pressure is more helpful in those conditions in which vascular and extravascular factors play the cardinal causative role in bleeding. Thus, the local application of pressure is of benefit in hereditary hemorrhagic telangiectasia, in the aged and debilitated patient and in bleeding associated with nutritional, hormonal and allergic disorders.

There are, in addition, a number of agents available which are capable of absorbing many times their weight in blood. This causes

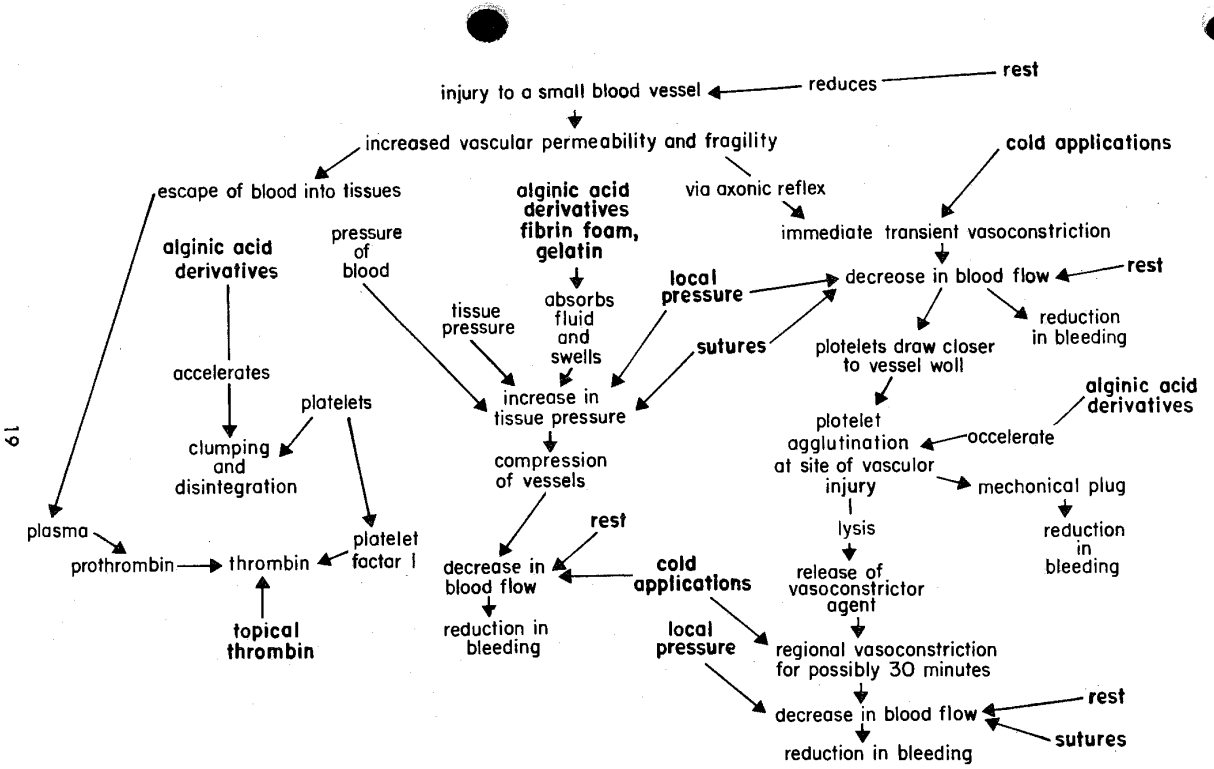

FIG. 14.—Action of local measures in the control of bleeding.

the material to swell and, in so doing, to exert pressure. Thus, they act in a tamponade manner to control the flow of blood (Fig. 14). The physiologic basis, for example, of starch sponge (Diconza, 1954) and alginic acid derivatives (Frantz, 1948) appears to have merit in this regard but requires further experimental evaluation.

REST.—The oral cavity is unique in that it is a zone which is subjected to constant microtraumata. Thus, under so-called "normal" conditions, capillaries are constantly being damaged and repaired. The reduction or elimination of such microtraumata is highly desirable under pathologic conditions, since it reduces permeability and fragility (Fig. 14). This is clinically executed by the instructions to the patient to imbibe liquids, avoid rough foods and reduce speech.

COAGULATION-PROMOTING AGENTS.—There is no doubt but that agents such as fibrin foam (Weiner and Wald, 1946), gelatin sponge (Light and Prentice, 1945), absorbable alkaline cellulose (Seegers and Sharp, 1948), topical thrombin (Tidrick *et al.*, 1943) and alginates (Frantz, 1948) are helpful in the control of bleeding. These materials, operating with local pressure and rest, are highly desirable principally when the pathosis is of the vascular and extravascular types. The one exception is topical thrombin (Fig. 14), which is effective only in the presence of thrombin insufficiency.

THERMOCAUTERY.—The control of bleeding by cautery is helpful in those circumstances in which the cause of bleeding is either in the vessel wall or extravascular. In other words, thermocautery is not effective for the control of hemorrhage due to coagulation defects (e.g., hemophilia). Actually, with thermocautery, one simply destroys tissue. The end result is a mechanical plug which, for a time, assists in the control of hemorrhage. However, it should be noted that other local measures are generally as effective, if not more so, than cautery.

APPLICATION OF ICE.—There is considerable physiologic proof that the application of cold yields vasoconstriction and, therefore, a reduction of blood flow (Fig. 14). However, the vascular response is only transient. Thus, cold applications can be regarded only as an adjunct to the control of hemorrhage due to vascular and extravascular pathosis. The effect of ice is enhanced when employed in connection with other local and systemic measures.

LOCAL VASOCONSTRICTOR AGENTS.—Sympathomimetic drugs are commonly applied locally for the control of hemorrhage. Most such preparations consist of 4–8% racemic epinephrine. These drugs produce prompt but transitory vasoconstriction and thus reduce blood flow for only a short time. Unless the hemorrhage is in the vessel wall itself and relatively minor, the effect of these agents is insignificant.

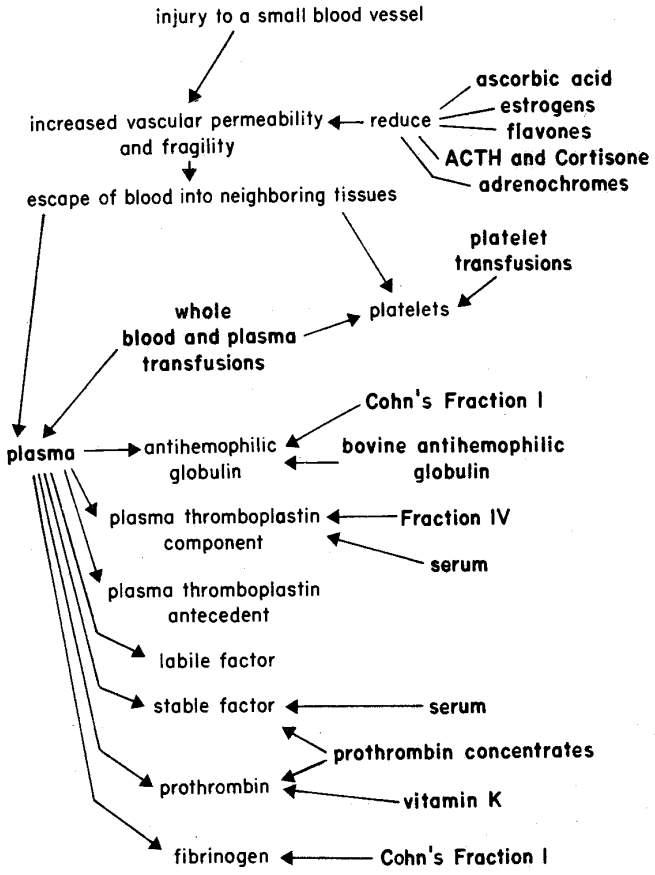

FIG. 15.—Action of systemic measures in the control of bleeding.

CHEMICAL ESCHAROTIC AGENTS.—The use, and particularly the continued application, of escharotic agents such as silver nitrate, phenol, chromic acid and trichloroacetic acid is to be deplored (Stefanini and Dameshek, 1955). These agents act by means of tissue destruction. The hemostatic effect is, therefore, fleeting. Other, more effective, substitutes are available.

ANTIMICROBIAL AGENTS.—The evidence, as already indicated, is clear that infection can produce toxic damage to the vascular endothelium with a resultant increase in permeability and fragility. Thus, one would think that the local application of chemotherapeutic and antibiotic agents to a bleeding site would be a helpful adjunct. However, although many such anti-infective preparations are available commercially, no extensive and carefully executed studies are available to support this premise as it pertains to oral bleeding.

SUTURES.—Suturing may be regarded as a helpful local measure. Here the intent is to increase the extravascular pressure with resultant compression of the traumatized vessel. This would mean slowing of the blood for a period of time. The use of sutures is helpful only in hemorrhage of vascular and extravascular origin.

CONCLUSIONS.—It should be clear from the foregoing account that (1) there are a variety of local hemostatic measures available, (2) they are more helpful in combinations than when used singly and (3) they are useful principally when bleeding is due to vascular and extravascular pathoses. It follows, then, that these local measures alone do not play a cardinal role in the control of bleeding due to intravascular defects.

SYSTEMIC MEASURES

The systemic devices and agents to be administered by mouth or injected subcutaneously, intramuscularly or intravenously with the expressed purpose of reducing or eliminating hemorrhage include: (1) *rest*; (2) *whole blood, serum and plasma*; (3) *plasma fractions*; (4) *platelets*; (5) *ACTH* and *cortisone*; (6) *estrogens*; (7) *ascorbic acid*; (8) *flavones*; (9) *vitamin K*; (10) *toluidine blue and protamine*; (11) *adrenochromes*; (12) *antimicrobial agents* and (13) *splenectomy* (Fig. 15).

REST.—Mention has already been made that reduced activity of the bleeding part is an important local measure in the control of bleeding. Reduced activity of the entire patient is also a helpful adjunct for hemostasis. This is so because rest invites sleep, and the end result is a reduction in cardiac output and blood pressure. Thus, in any type of serious bleeding, it is highly desirable, if not essential,

to reduce intravascular pressure. This can be best accomplished by bed rest.

WHOLE BLOOD, SERUM AND PLASMA.—There is only one situation in which, without reservation, whole blood transfusions are required; and that is when hemorrhage has been severe enough to produce anemia. However, the transfusion of whole blood is also beneficial in any hemorrhagic state in which there has been depletion of one or more of the blood components. In other words, bleeding due to an intravascular defect can be aided by whole blood transfusions if enough can be transfused. However, it should be emphasized that transfusions of whole blood and even serum and plasma may be wasteful and sometimes even dangerous. For example, plasma contains about 300 mg./100 ml. fibrinogen and 7 mg./100 cc. prothrombin (Cohn *et al.,* 1950). Obviously, these amounts are too small to raise significantly the patient's level of fibrinogen and prothrombin in situations in which the primary intravascular problem is hypothrombinemia and fibrinogenopenia. Thus, it is desirable in such instances to administer to the patient specific purified fractions designed to replace the specific deficient components.

PLASMA FRACTIONS.—A number of plasma components are now available, and there is every reason to believe that more will be developed for clinical use in the very near future. Thus, it is possible at this time to provide the deficient patient with concentrated amounts of stable factor (Alexander *et al.,* 1950), labile factor (Owren, 1948), prothrombin (Seegers, 1953), plasma thromboplastin component (Aggeler, 1954), antihemophilic globulin (MacFarlane *et al.,* 1954) and combinations such as Cohn's fraction I, which contains antihemophilic globulin plus fibrinogen (Cohn *et al.,* 1950).

PLATELET TRANSFUSION.—The importance of the thrombocytes in hemostasis cannot be overemphasized. It should be recalled that the platelets participate in almost every phase of the hemostatic process (Fig. 11). Considerable research has yielded significant advances in the technics for the collection, preservation and transfusion of thrombocytes (Stefanini and Bernfeld, 1953). The purpose, when platelets are transfused, is to deliver not only intact thrombocytes but also their products. The indication for platelet transfusion is primarily thrombocytopenia, and particularly when it is of the idiopathic type.

ACTH AND CORTISONE.—These hormones have been shown to exert a nonspecific but well-defined effect on the capillary wall (Kramar, 1954). The mechanism for this action is still unknown. However, it appears that the adrenocorticotropic hormone and glu-

cocorticoids operate by decreasing capillary permeability and fragility. Moreover, there is also a demonstrable shortening of the bleeding and clotting time and stimulation of bone marrow activity.

ESTROGENS.—Exactly how the female sex hormones operate in the hemostatic process is still not clear. However, it is certain that the estrogens play a role. For instance, it has been observed in women that bleeding seems to be more marked at the termination of the secretory phase of the menstrual cycle. This is the period when the estrogen level is lowest and the urinary excretion of gonadotropin at a peak. There is also additional evidence to indicate that telangiectatic and other types of vascular hemorrhage may be ameliorated by the parenteral use of estrogens (Whittington, 1956).

ASCORBIC ACID.—A number of articles have appeared in the literature which underscore the fact that ascorbic acid is essential for the synthesis and maintenance of the endothelial cement substance (Pijoan and Lozner, 1944). Thus, it follows that an ascorbic acid deficiency leads to increased capillary permeability. This has been confirmed by the observation that the addition of vitamin C to a therapeutic regimen often reduces or eliminates hemorrhage (Mead, 1944). Additional support is available from studies showing that ascorbic acid tends to reduce the hemorrhagic effect of Dicumarol at given prothrombin levels.

FLAVONES.—These substances and their derivatives, including flavones (hesperidin), flavonols (rutin), flavins (epicatechin), and coumarins (Levitan, 1949), have been shown to decrease capillary permeability. However, their action is very slow and requires a long period with the particular agent. Unfortunately, they can only be used, if at all, for prophylaxis rather than as therapeutic agents.

VITAMIN K.—This vitamin fraction is indispensable for the manufacture of prothrombin (Collentine and Quick, 1951) by the liver. It is often presumed that most hemorrhagic defects are the result of a vitamin K deficiency. At least, this agent is prescribed to dental patients more often than any other hemostatic drug despite the fact that it is seldom indicated (Sutherland, 1956). Evidence in support of this statement may be found in the Australian study in which only 1 of 232 patients undergoing routine exodontic procedures showed a prothrombin level as low as 75% of the accepted norm. Vitamin K exerts its primary effect on the production of prothrombin.

Since, as has already been indicated, intravascular pathosis is not common, it follows that, in most cases, vitamin K serves no purpose in the control of oral bleeding.

TOLUIDINE BLUE AND PROTAMINE.—There are circumstances in which hemorrhage is due to the presence of circulating heparin-like factors. In such cases, toluidine blue, a complex dye with an affinity for certain circulating anticoagulants, or protamine sulfate may serve as a satisfactory hemostatic agent (Allen, 1948).

ADRENOCHROMES.—The local hemostatic effect of epinephrine has already been referred to in an earlier section. However, its side effects and transient action preclude its usefulness except in the most minor types of vascular bleeding. It has been observed that the oxidation of epinephrine produces adrenochrome, which has been reported to be an excellent hemostatic agent free of the usual sympathomimetic side effects. A product of adrenochrome, monosemicarbazone in combination with sodium salicylate, is presently available for oral and intramuscular administration. It is claimed that its principal effect is one of reducing capillary permeability (Perkins, 1957). However, the investigation of adrenochrome monosemicarbazone salicylate is limited, and its clinical usefulness must await more carefully controlled studies.

ANTIMICROBIAL AGENTS.—The possibility of local action of antimicrobial agents for hemostatic purposes has already been mentioned. Once again, it is well to underscore the fact that invading microbes and/or their toxins can exert a deleterious effect on the vascular wall, leading to increased permeability and fragility. However, there is still no well-defined experimental study in stomatology to show that bleeding can be better controlled with the use of antiinfective drugs given locally or systemically.

SPLENECTOMY.—The exact role played by the spleen in hemopoiesis is still subject to debate. In recent years the term "hypersplenism" has received renewed attention. The presumed overactivity of the spleen has been shown to lead to a reduction of erythrocytes, leukocytes and/or platelets. Of particular pertinence to this discussion is the possibility of a thrombocytopenia with its attendant dangers. Therefore, there are situations, although admittedly uncommon, where splenectomy is recommended for relief from a hemorrhagic diathesis.

DIAGNOSIS OF A HEMORRHAGIC DISORDER

The recognition of the etiology of any problem, and therefore of a bleeding tendency, can only be reached by (1) *the history,* (2) *clinical examination* and (3) *laboratory investigation.*

History and Clinical Examination

It should be evident from a study of the diverse origins of bleeding disorders that symptoms and signs may appear in any one of the organs or systems of the body. In the case of chronic minimal bleeding, *anemia* is a likely sign. The end result is a reduction of the oxygen-carrying capacity of the blood. Thus, the anemic patient complains of easy fatigability, restlessness, nervousness, dyspnea and general malaise. One can very often observe pallor and other evidence of chronic debilitation. Unfortunately, these symptoms and signs are part and parcel of hundreds of syndromes and, therefore, are not pathognomonic of any one disorder.

There are some few symptoms and signs which should put the examiner on guard for a possible hemorrhagic tendency. One such frequently significant finding is the story by the patient of ready bleeding following simple cuts and bruises, such as would occur during shaving. A second observation which can be extremely diagnostic is a history of bruisability. There are many persons who report so-called black-and-blue marks and cannot recount any relationship between these ecchymoses and trauma. For example, many women describe such ecchymotic lesions on arising in the morning without any history of significant injury. A story of a hemorrhagic tendency in other members of the family is always of great importance and should be checked very carefully. Of particular significance to the stomatologist is the finding of oral bleeding with minimal trauma, such as occurs with toothbrushing or during eating. As a matter of fact, the dentist actually performs a bleeding test every time he extracts a tooth and, in effect, is afforded the opportunity to observe the patient's ability for physiologic hemostasis following a procedure necessarily characterized by a certain amount of mechanical trauma.

Laboratory Examination

The *bleeding* and *clotting times* are the most commonly used laboratory tests for the detection of the bleeding tendency. The general statement can be made that, if either or both of these procedures prove positive, there is a strong possibility of a hemorrhagic disorder. However, if the bleeding and/or clotting times are within normal limits (and this is much more often the case), one cannot eliminate the possibility of a bleeding tendency. Thus, the problem is one of determining what laboratory tests one should perform in order to ascertain the presence or absence of the hemorrhagic diathesis.

Two items of interest become apparent if one asks any hematologist this question. First, all authorities are agreed that the bleeding

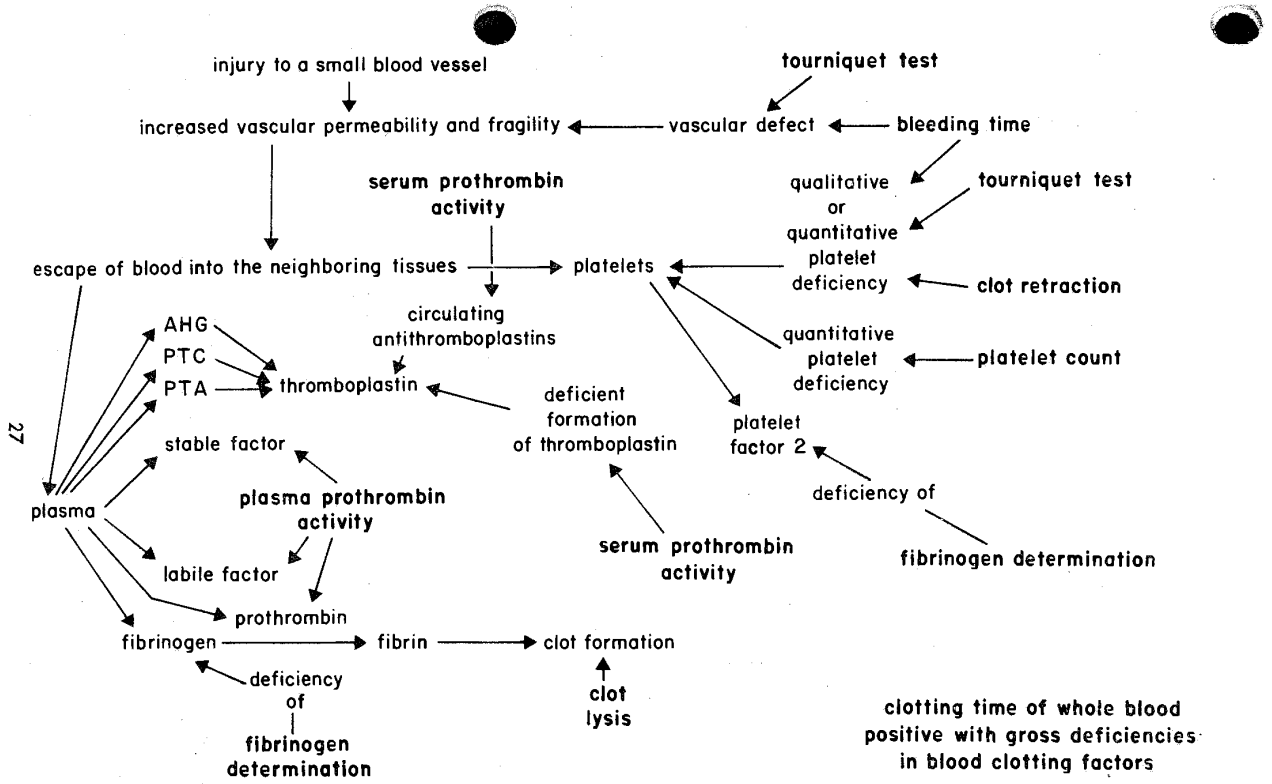

FIG. 16.—Recommended screening procedures for the detection of the hemorrhagic diathesis.

and clotting times do not constitute adequate laboratory screening. Second, all experts concur that a battery of tests should be performed. However, there is some disagreement as to what procedures should be incorporated in the screening regime. One group (Stefanini and Dameshek, 1955) suggests nine procedures by which most patients with a bleeding diathesis can be detected and even grossly classified. Collectively, these procedures can be done with approximately 8 cc. of blood; and a report, with the exception of clot lysis, can be obtained within 2 hours.

Figure 16 shows the battery of procedures which is recommended and indicates where in the hemostatic mechanism the procedures provide diagnostic information. An examination of Figure 16 shows that most of the procedures (with the possible exception of the bleeding time and tourniquet test) measure *intravascular* defects. In light of the fact that the *vascular* problems are much more common and important to the stomatologist, and because of the relative absence of vascular tests, it is imperative that the tourniquet test be performed.

SUMMARY

1. Physiologic hemostasis involves the delicate interplay of extravascular, vascular and intravascular mechanisms.

2. Studies on the incidence of bleeding suggest that defects in the vessel wall probably represent the most common group of causes for bleeding.

3. A host of local and systemic measures are available for the control of bleeding. Generally, a combination of measures produces the most desired results.

4. The diagnosis of the hemorrhagic diathesis depends on a careful history, clinical examination and laboratory studies.

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