IN THE LABORATORY

The Ecchymosis Test for Capillary Hemorrhagic Diathesis[1]

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A large number of clinical tests have been devised for estimating the degree of capillary fragility. These tests are based on petechial counts following applications of positive or negative pressure and indicate the strain required to rupture the blood capillaries of the skin. These methods do not always test a hemorrhagic diathesis associated with increased capillary fragility. Moreover, clinical conditions without a hemorrhagic tendency are known which exhibit increased capillary fragility (*3*).

The ecchymosis test measures the strength and hemorrhagic diathesis of skin capillaries expressed by the amount of pressure necessary for the production of ecchymosis and the degree of ecchymotic involvement of the tested area. It is made in full daylight or at equivalent artificial light. There is no need for a magnifying lens, though an electrically illuminated 5-power magnifier has been found to be a convenient aid.

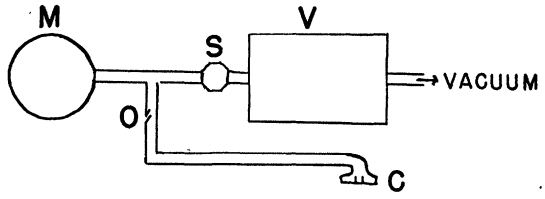

FIG. 1

A vacuum pump which permits high negative pressures is attached to a vacuum chamber. The vacuum in the system is subjected to as rapidly increasing pressure as possible. A special device, schematically diagrammed in Fig. 1, permits these pressures to be increased or reduced within a few seconds. It also secures the maintenance of a desired pressure for any length of time. This is accomplished by turning the screw of a needle valve (S), attached to the vacuum chamber (V), until the manometer (M) shows that the desired negative pressure has been reached. A T-tube connects a suction cup (C) with the manometer and the vacuum chamber. The T-tube has a minute opening (O), permitting rapid release of the pressure. (Such an opening can also be secured by piercing a gauge-20 needle through the wall of the connective rubber tubing.)[2]

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[2] A portable, light-weight apparatus termed "purpurameter" has been devised and can be obtained from the C. M. Sorensen Company, New York City.

The test is performed as follows: A suction cup of 4.5-mm internal diameter is placed on the skin in the internal brachial region, 3–9 cm below the apex of the axilla, and negative pressures in increments of 100, beginning with −100 to −600 each, are applied for 2 min on different parts of the skin in this region. The degree of ecchymosis is read immediately following the sudden release of the pressure. Large petechiae may constitute a beginning ecchymotic lesion. They may consist originally of several small petechiae which had become confluent, or they may mark extravasation from one single injured capillary. Therefore, such large petechiae were designated as ±, or doubtful ecchymosis. Three degrees of ecchymosis are differentiated: 1+, or feeble, consisting of large ecchymotic plaques; 2+, or moderate; and 3+, or strong ecchymosis. The latter covers almost the entire area. The area becomes hyperemic as a result of the applied pressure. If there is any doubt as to whether an undeniably ecchymotic spot or area is present, plain glass or Lucite should be pressed down on it. The hyperemic area will blanch, whereas the visibility of the hemorrhagic manifestation will remain unaltered or even increase.

The test permitted the detection of a capillary hemorrhagic diathesis in a group of subjects with a history and manifestations of capillary bleeding. It has also been studied in a control group of 51 subjects—students and investigators at the Marine Biological Laboratory (*2*). In healthy subjects, pressures up to −500 mm Hg, and in other instances up to −600 mm Hg, were found to produce petechiae in varying numbers, but no ecchymotic lesions. In cases with capillary hemorrhagic diathesis, pressures up to −300 mm Hg produced ecchymosis. The ecchymosis test proved useful in evaluating the effect of rutin therapy in 3 patients with vascular purpura. A significant reduction in the production and degree of ecchymosis was observed in these cases after rutin therapy.

The selection of the internal brachial region for making petechial counts, which was made by trial and error, resulted in the development of the ecchymosis test. Cosmetic considerations make this site also preferable in female subjects. Contiguous cutaneous regions are not suitable because of the increased thickness of the epidermis. Copley and Kozam (*2*) found that the internal brachial region tended to yield higher petechial counts, and, in some cases, an increased ecchymotic production when compared with observations of studies on the supraclavicular and infraclavicular regions. A suction cup of 4.5-mm internal diameter was found to be more suitable than the larger suction cups which are generally used in petechial count methods. This cup covers an area of 15.7 mm^2 and thus permits repeated tests in the same region on the same day. Although the test period can be varied, a 2-min period was found adequate.

The mechanism of ecchymotic formation is not understood. There may be qualitative differences between the hemorrhagic manifestations of petechiae and of ecchymosis, the latter possibly being more characteristic for certain conditions. High negative pressures may produce many petechiae without a tendency to form an ecchymosis.

The ecchymosis test is a simple, painless, clinical procedure which permits rapid readings and which may prove to measure more adequately the strength and hemorrhagic diathesis of skin capillaries than the various methods of petechial counts hitherto employed in man. It can be used in different regions of the human body and can also be applied to experimental animals. With it, the local or systemic effect of drugs, chemical agents, and other treatments can be tested.

References

1. COPLEY, A. L. (To be published.)
2. COPLEY, A. L., and KOZAM, G. Unpublished data.
3. PECK, S. M., and COPLEY, A. L. *New Eng. J. Med.*, 1946, **235**, 900.

Method for Making Cartesian Divers

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The problem of making Cartesian divers is among the first to confront the investigator who becomes interested in Cartesian diver technique (*2*, *3*). This heretofore time-consuming and difficult operation can be reduced to a controlled routine procedure by the method to be described. This method differs from those described by Boell, Needham, and Rogers (*1*) and Holter (*2*) in that, instead of being a free-hand operation requiring considerable practice and skill in glass blowing, the various stages in the process are carried out in a jig which keeps the capillary in alignment at all times. Not only do the divers tend to be more nearly uniform and symmetrical but, by slight modification of the technique, it is possible very easily to make flat-bottomed divers (Erlenmeyer type) (*2*) and divers with either thick or thin tails.

Thick-walled Pyrex capillary tubing is selected. This may vary in outside diameter from .030″ to .060″ (0.762–1.524 mm), depending on the size of diver desired. A hot needle-point flame is adjusted on a micro-gas burner[1] using a mixture of gas and compressed air. The jig[2] (Fig. 1A), made of aluminum or brass, is composed of two parts, a stationary part attached to a handle and a removable part. There are two sets of paired holes in the jig, one each for making divers with relatively thick tails and with thin tails. In the first set, the paired set of holes are the same size; in the second, the paired holes differ in size. (The holes in the removable section are all the same size, being made by a very small drill—#77 drill, .018″.) This is done so that the thin rod of the "blank" will not wobble while it is twirled in the jig.

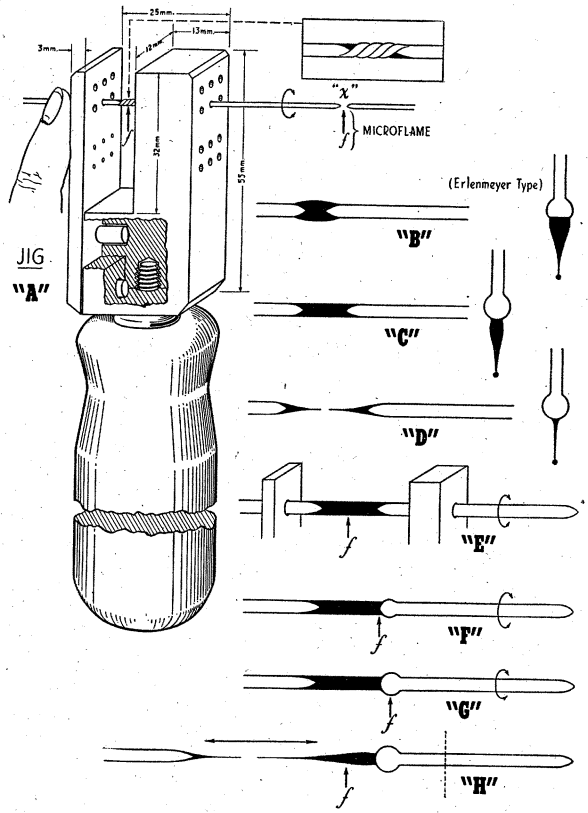

FIG. 1

Suitable drills for making the holes which will accommodate capillaries with outside diameters of .038″–.057″ are as follows: #53, .059″; #54, .055″; #55, .052″; #56, .046″; #57, .043″; #58, .042″; #59, .041″; and #60, .040″. When a capillary of convenient length has been selected it is inserted into the hole in the jig which best accommodates it so that it can be twirled easily, without wobbling. With the capillary inserted in the jig so that about 20 mm protrudes from the left side, the jig is held in the left hand in such a manner that the forefinger of that hand can push lightly against the protruding capillary and, when necessary, keep it from turning, and also in such a manner that the flame melts the glass in the middle of the jig (Fig. 1A). When the capillary is collapsed and the glass is molten over an area of 3–4 mm, the capillary protruding from the left side is held with the forefinger of the left hand, and the glass on the right-hand side of the jig is twisted 3 or 4 complete revolutions. This effectively seals off the lumen of the capillary from the rod and helps eliminate air bubbles. The pressure from the left forefinger is then released,

[1] A suitable micro-gas burner is the Orthodontic Blow Pipe #11, distributed by S. S. White Dental Manufacturing Company, Philadelphia, Pennsylvania.

[2] The jig is available from Carl A. Moeller, 242 Warren Street, Randolph, Massachusetts.