

full range of motion with different amounts of fluid within the joint. The point of least pressure corresponds closely with the position maintained by a limb containing a palpable effusion. By means of a hypertonic saline solution containing methylene blue we demonstrated that drainage was dependent upon joint movement.

These observations indicate that fluids poor in, or, free from colloidal materials will be drained rapidly from the joint space by way of the lymphatics when joint motion occurs. Fluids containing colloidal material which exerts an osmotic pressure may be concentrated until the osmotic pressure of the fluid equals the highest intra-articular pressure attainable by joint motion. Our observations suggest that even colloidal material may filter through the lymphatic capillary membrane when high intra-articular pressures are produced, but it is well known from clinical experience that the absorption of joint effusions is slow when the protein content is appreciably elevated.

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Hemorrhagic Glomerular Lesions Produced by Filtrates of *Streptococcus Viridans* Cultures.

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It is well known that hemorrhagic, glomerulo-nephritis occurs with great frequency in association with *Streptococcus viridans* endocarditis. The glomerular changes are generally regarded as a direct result of damage caused by minute emboli from the vegetations on the heart valves. The following considerations led us to question the assumed embolic nature of the nephritis: (1) If the nephritis associated with *Streptococcus viridans* endocarditis is merely the result of emboli, one might reasonably expect to encounter a similar nephritis quite as commonly in every form of endocarditis characterized by profuse, friable vegetations, regardless of the etiology. This, however, is not the case. (2) There is no relation between the size of the valvular vegetations and the occurrence or degree of nephritis. (3) We have observed florid hemorrhagic nephritis in association with gonococcal endocarditis, in which the vegetations were confined to the right side of the heart, and in which therefore,

the capillary bed of the lungs could act as a filter for emboli escaping from the vegetations. It may be remarked that gonococcal endocarditis resembles *Streptococcus viridans* endocarditis in the extraordinary frequency with which it is accompanied by hemorrhagic nephritis. (4) Our microscopic studies failed to convince us that damage to glomerular tufts in the nephritis associated with *Streptococcus viridans* endocarditis is necessarily dependent upon the presence of emboli. (5) The glomerular damage differs in no way from that observed in cases of nephritis in which emboli could have played no rôle.

It seemed possible that the high incidence of nephritis occurring in association with certain forms of bacterial endocarditis might be referable to the action of toxins produced by the microorganisms in question, rather than to emboli. We, have, therefore, carried out experiments with a strain of *Streptococcus viridans* which was obtained from the blood of a patient suffering, in a typical manner, from subacute endocarditis, with evidences of renal involvement.

Briefly, we were able to produce glomerular damage in rabbits by the intravenous injection of bacteria-free filtrates of fresh broth cultures of this organism. The sterility of the filtrates was always proven by culture. The amount of filtrate injected varied between 2 and 20 cc., and the animals were killed on the day following the injection. There was no definite relation between the amount injected and the degree of renal injury produced. Some unexplained individual susceptibility played a greater rôle.

Realizing the sources of error involved in the interpretation of apparent cellular alterations in the glomerular tuft, we have regarded as positive only those cases in which actual hemorrhages occurred into Bowman's capsule and the convoluted tubules. The hemorrhages visible at autopsy in the gross varied in number from only one or two to a profuse peppering of the cortex of each kidney. Microscopically, the hemorrhages were always in Bowman's capsule or the tubules, never in the interstitial tissue, and in all instances the escaped blood was perfectly fresh in appearance. In no case did the control injections of broth alone affect the kidney.

Mention of spontaneous, hemorrhagic glomerulo-nephritis in the rabbit is of excessive rarity in the literature. We have never encountered it in the study of the kidneys of hundreds of rabbits killed for other purposes during the past several years, and our control series of 90 rabbits were free from it. We feel, therefore, that the present experiments demonstrate clearly that, in the Berkeley filtrates of broth cultures of a pathogenic strain of *Streptococcus viridans* there is something which can produce glomerular dam-

TABLE I.

Material Injected	No. of Animals used	Animals showing glomerular hemorrhages at autopsy	Animals showing no hemorrhages at autopsy	Animals showing glomerular hemorrhages
Living <i>Strep. viridans</i>	29	9	20	% 45
Heat killed <i>Strep. viridans</i>	23	4	19	21
Berkefeld filtrate of broth culture <i>Strep. viridans</i>	79	17	62	28
Broth alone	90	0	90	0

age in the rabbit. As far as we are aware, this is the first time that a condition comparable to acute hemorrhagic glomerulo-nephritis has been produced experimentally by means of a bacterial filtrate.

Whether or not we are dealing with a true toxin cannot yet be stated. We have evidence, however, that the renal damage in our experiments has nothing to do with allergy. We can offer no explanation for the differences in individual susceptibility to the injurious substance in these experiments. The same problem confronts us in cases of infection with the *Streptococcus viridans* in the human being. Our efforts to concentrate the toxic principle of the filtrate and so to obtain, possibly, a higher percentage of instances of renal involvement have not yet been successful. Our experiments planned to subject animals to repeated injections over a period of time are incomplete. In a limited number of experiments in which filtrates of cultures of other bacteria were injected, no renal changes were produced.

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Induction of Anesthesia in Man by Intravenous Injection of Sodium Iso-Amyl-Ethyl Barbiturate.

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During the last 6 years the sodium salt of iso-amyl-ethyl barbituric acid has been used extensively as a general anesthetic in