CRYSTALLINE DEPOSITS IN THE VITREOUS, WITH A REPORT OF TWO CASES OF CALCIUM SOAPS STUDIED MICROSCOPICALLY AND HISTO-CHEMICALLY*  

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Crystalline formations in the vitreous have usually been described under the head of "synchysis scintillans" or "asteroid hyalitis." The former, "synchysis scintillans," has been almost universally described as a fluid vitreous in which cholesterol crystals are suspended and reflect the light brilliantly when viewed with an ophthalmoscope; while the latter, "asteroid hyalitis," was first described by Benson in 1894 as creamy, star-like bodies occurring in a non-fluid vitreous. Since 1894 there have been numerous reports of this condition. A few writers have made differentiations between these diseases, but others either have made no distinction or have used the terms interchangeably.

For the authors who take the stand that both conditions are crystals suspended in the vitreous, the diseases are the same; and certainly, if we analyze earlier reports, we are led to believe that all crystalline bodies in the vitreous were classified as "synchysis scintillans" until Benson's report in 1894. Many writers since then have failed to make any differentiation. Some distinguish the silvery white from the gold or reddish-yellow tinged opacities. Undoubtedly these variations in color are points of difference. If we use the term "Scintillans Corporis Vitrei," that Feingold used in classifying Bachstez' cases, we would consider them the same, as certainly these snowball opacities do sparkle or

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scintillate. If we attempt to differentiate between them from the etiologic standpoint or from the standpoint of treatment, there is nothing to distinguish them, as in each case the etiology is unknown and therapy is without avail.

As previously mentioned, many writers have used the terms “asteroid hyalitis” and “synchysis scintillans” interchangeably. Weidler, in 1922, reported “asteroid bodies in the vitreous” and then spoke of them as “cholesterol crystals,” while Butler, in “An Illustrated Guide to the Slit-Lamp,” spoke of the globules in asteroid hyalitis and said, “The globules are not crystalline and they are not composed of cholesterol. Most cases of synchysis scintillans are of this nature.”

On the other hand, the chemical composition of the bodies is quite different, as shown by Verhoeff and also by Bachstez, and we can probably make the differentiation with the ophthalmoscope and the slit-lamp. Bachstez described his case as “synchysis scintillans,” yet chemically he found the bodies to be lipoid in character, which analysis, as Feingold contended, would classify them as “asteroid hyalitis.” Bachstez reported upon four eyes. He studied two chemically and found the opacities to be chiefly the calcium salt of a fatty acid. He believed these conditions should be classified as follows:

I. Fluid vitreous bodies—synchysis.
   (1) Synchysis scintillans—usually cholesterol crystals.
   (2) Synchysis nivea oder albescens—white opacities.
      Not sharply defined. Chemistry unknown. Leucin and tyrosin suspected.

II: Vitreous not fluid—scintillans.
   (1) Not sharply defined flakes. Described clinically only.
   (2) Sharply defined globules. Chemically, mainly calcium salt of a fatty acid. Histologically described.
Diagnosis.—Verhoeff stated that the conditions may be easily differentiated, and Holloway seemed to think there should be little difficulty in this task, but how can one be certain of his diagnosis unless the eye is later sectioned and the crystals studied both microscopically and chemically? Only a very few such studies have been made, especially in reference to the crystals in "asteroid hyalitis," the only ones previously studied being those of Verhoeff and Bachstez, to which reference has been made. Even authorities disagree as to diagnosis. One case was seen recently in which two well-known American ophthalmologists held opposite views, and a well-known English writer was not at that time familiar with the term "asteroid hyalitis." This experience demonstrates that among well-recognized oculists there is a considerable divergence of opinion.

Not until we have seen the ophthalmoscopic and slit-lamp appearance of a case and later determined the chemical composition of the bodies will we be reasonably sure of our diagnosis; and even then there may be considerable confusion if later we find that other crystalline bodies occur in the vitreous.

After having studied the cases which are to be reported, the one microscopically, chemically, and with the slit-lamp, and the other with the ophthalmoscope, slit-lamp, and later chemically and microscopically, the writer feels reasonably sure that he can differentiate between the calcium fatty acid salts and the cholesterol crystals in the living eye. The first case could not be studied ophthalmoscopically because of corneal and lenticular opacities, but the second one was seen thirteen months before the eye was enucleated and a diagnosis of "asteroid hyalitis" was made by the ophthalmoscopic appearance.

The history of Case I was submitted by a colleague, Dr. H. K. Fleck, who treated the patient and sent me the eye for examination.
Case I.—W. E., white male, aged thirty years, was struck in the right eye January 14, 1925, following a dynamite explosion, and was treated at a hospital in Columbia, Pa. The patient came for advice about the injured eye because it was still painful and he was unable to see.

External Examination.—There was slight circumcorneal injection and a scar in the center of the cornea to which the iris was adherent. The capsule of the lens was ruptured and the lens substance projected into the anterior chamber. There was no reaction of the iris to light. The tension was subnormal. V.R.E. = blind; L.E. = 20/20. Ophthalmoscopically, in the right eye the fundus could not be seen; in the left eye the fundus was normal.

In view of pain and absence of light perception, enucleation was advised and accepted. The operation was performed on April 9, 1925.

Microscopic Examination.—The cornea showed a central leukoma from an old perforating wound to which the iris and lens capsule were adherent. The iris was necrotic and adherent anteriorly to the cornea both centrally and peripherally, and many new-formed vessels were present. The pigment epithelium stood out very prominently. In the pupillary area there was an organized mass which consisted of connective tissue and lens capsule and which contained a few giant-cells. A very small amount of broken-down lens substance was found between the anterior and posterior capsules. The ciliary bodies were somewhat atrophic. The retina showed large and small hemorrhages in the superficial layers, especially posteriorly; vacuoles were present near the ora serrata. The nerve showed an increase in the fibrous portion with some cellular infiltration, and the central vessels appeared to be thrombosed. The choroid showed marked engorgement of the vessels and the uveal pigment was prominent. The vitreous contained numerous cells—some were leukocytes and others were small round cells. Throughout the vitreous were crystalline masses of varying size which were bright by reflected light, and brownish by transmitted light.

Chemical Examination.—A portion of the vitreous containing the bodies was removed and the masses were found to be insoluble in 90 per cent. sulphuric acid, insoluble in ether, negative to murexid, negative to Millon's, and stained slightly after some time with Scharlach.

Slit-lamp Examination.—One-half of the globe which was
Fig. 1.—Slit-lamp appearance of Case I. The bodies are of irregular size and are generally spherical in shape.
preserved in formalin was studied with the slit-lamp in order to become familiar with the appearance at this magnification (low power 20). Most of the bodies were either round or irregularly round and showed motion as the receptacle was moved, although the vitreous was not fluid. The bodies varied in color—some were quite light and others brown, but the prevailing color was more or less a cream. Other bodies were deposited on the surface of the retina (fig. 1).

CASE II.—D. O'C., aged fifty-eight years, was first seen in the Out-Patient Department of the Johns Hopkins Hospital in July, 1922, by Dr. Reginald West, who found a marked exophthalmos of the right eye due to a tumor of the right antrum. The patient was referred to the Department of Laryngology, where a radical antrum operation was performed, at which time a tumor was found and diagnosed as a cylindroma. After he recovered from the operation he was sent to Dr. Kelly's Hospital, where he received radium treatment. In the spring of 1926 he was admitted to the Johns Hopkins Hospital several times because of severe nasal hemorrhages. He was seen November 29, 1926, in the eye clinic by Dr. Fechtig, who made a note that the eye was blind and that the vitreous contained cholesterol crystals. On December 15, 1926, the eye was examined by the author, who made a note on the chart that the bright bodies in the vitreous were round and irregular and of slow movement, and diagnosed the condition as one of asteroid hyalitis. The patient continued to have frequent hemorrhages from the ulcerated tumor mass. On December 16, 1927, the patient was re-admitted to the hospital. Severe pain developed in the right eye and he was transferred to the Wilmer Clinic on December 26, 1927.

A slit-lamp study of the vitreous opacities showed that most of these were small and round, showing a yellowish tinge, while others were of gray appearance.

The right orbit was eviscerated on December 28, 1927. The tumor mass was present chiefly on the floor of the orbit and extended backward toward the optic nerve. The patient made an uneventful recovery from the operation and was discharged from the hospital January 19, 1928. He continued to report to the Nose and Throat Clinic until April 4, 1928, when he entered the Jenkins Home for Incurables, where he died on June 25, 1928.

The pathologic report was that the tumor mass which was removed from the orbit was of the same character as that previously removed from the nose, and diagnosed as a cylindroma.
Macrosopic Examination.—The eye was surrounded by a tumor growth, especially below. The globe was sectioned vertically at the temporal side of the nerve. The anteroposterior diameter was 24 mm. and the horizontal diameter 25 mm. The vitreous was not fluid, but contained bright shining particles (fig. 2). A small round hemorrhage was seen 3 mm. to the nasal side of the nerve.

Microscopic Examination.—Both corneal epithelium and substantia propria were normal. The iris showed no pigment cells in the stroma, but a well-marked pigmented uveal layer was present. At the root of the iris was a small cyst covered by pigmented epithelium. The choroid seemed slightly thinned, with some areas with lessened pigment and others with increased pigment. On the surface of the retina was a fibrinous-like structure in which were enmeshed numerous round bodies of various sizes which were slightly stained with hematoxylin (fig. 4). These same bodies were negative to iron and van Gieson stains. A few hemorrhages were present in the retina, which were probably postoperative.

Chemical Examination.—Some of the vitreous was removed. It was found that the crystalline bodies were insoluble in ether, insoluble in hydrochloric and nitric acids, and slightly soluble in chloroform. They stained pink with Scharlach R after drying, and repeated applications of ether with evaporation, followed by Scharlach R, showed fat-droplets. Hemin test was entirely negative.

In view of these findings the author feels certain of the clinical diagnosis of calcium soaps in the vitreous, formerly called "asteroid hyalitis."

Since making these pathologic studies and slit-lamp examinations six cases have been seen clinically with crystalline bodies in the vitreous. Five of these belonged to Bachstez’ Group II, sec. 2, namely: sharply defined globules in a non-fluid vitreous, which probably were calcium fatty acid salts, and which showed under the slit-lamp round or irregularly round bodies, cream or brownish in color, with slow motion, yet which were quite brilliant when viewed with the ophthalmoscope. Four of these cases were unilateral, yet outside of these bodies no difference could be detected ophthalmoscopically except in the second case. The sixth case would be
Fig. 2.—Microscopic appearance of bodies seen with the low power.

Fig. 3.—Microphotograph of cholesterol crystals from the vitreous of a case of phthisis bulbi.

Fig. 4.—A section of the eye showing bodies caught in the vitreous.
classified under Bachstez' Group I, sec. 1: synchysis scintillans—fluid vitreous—usually cholesterol crystals. This case when studied with the slit-lamp showed a brilliant shower of crystalline bodies which moved so rapidly that it was impossible to tell whether they were round or angular. These undoubtedly were cholesterol crystals. A specimen of vitreous showed cholesterol crystals with their characteristic shape and chemical reactions (fig. 3). These were found in the vitreous of a patient with phthisis bulbi. This case was not studied ophtalmoscopically because the cornea was entirely opaque when first examined.

It is thought by some writers that these two conditions are due to severe inflammatory reactions. Of the reported cases, some have shown such lesions as glaucoma, hemorrhages into the retina, venous thrombosis, etc., but it seems that any one of these conditions was as much an incident as an etiologic factor, for usually the clinical cases have little or no evidence of pathologic changes and only the more severe cases are enucleated and studied histo-chemically.

The first case of calcium soap here described followed a perforating wound. At the time of examination the eye showed hemorrhages in the retina, which may have been a contributing factor. The second case showed some slight changes in the fundus and its metabolism was undoubtedly altered by the associated tumor. The writer cannot confirm the opinion of Stark, who thought that syphilis played a rôle, nor that of Bailey, who considers tuberculosis an etiologic factor. Verhoeff says the condition is usually, if not always, due to ocular angiosclerosis in association with altered condition of the blood, but this hardly explains the unilateral cases where no opthalmoscopic changes are found.

While Holloway has been given the credit of calling the so-called asteroid bodies "snowball opacities" (1917), Argyll-Robertson was the first to mention them as such (1894). There is very serious objection to the term "asteroid
hyalitis," as asteroid is from a Greek word meaning star, and hyalitis from another Greek word meaning inflammation of the vitreous. As yet no proof has been brought forward of any such pathologic entity. Likewise, we could with perfect propriety criticize the term "Synchysis Scintillans." Synchysis is derived from a Greek word meaning fluid, and scintillans from a Latin word meaning sparkling. Literally we have "fluid sparkling," which term is not especially comprehensive.

From the six clinical cases presented and the two histochemically studied, it seems that a modification of Bachstez' classification in the following form might be used with benefit:

I. Fluid vitreous bodies with crystalline opacities.
   (1) Cholesterol crystals. White, shining opacities sharply defined and giving the appearance of a snowstorm.
   (2) White opacities not sharply defined. Leucin and tyrosin suspected.

II. Non-fluid vitreous bodies with crystalline opacities.
   (1) Sharply defined globules of slow movement, chiefly calcium soaps. Histologically described and chemically studied.
   (2) Not sharply defined flakes. Described clinically only.

Group I, type 1, is demonstrated in the sixth case studied clinically. Formerly it would have fallen into those classified as "Synchysis Scintillans."

Group II, type 1, is illustrated by the enucleated eyes and the first five clinical cases. According to Benson's classification these would have been called "Asteroid Hyalitis."

If this classification seems too cumbersome, then it is suggested we use the terms "Cholesterol Crystals in the Vitreous," "Calcium Soaps in the Vitreous."
REFERENCES

Weidler: Arch. Ophth., li, p. 179.
Holloway: Arch. Ophth., xiv, p. 50.

MICROCHEMICAL AND HISTOLOGICAL FINDINGS
IN A CASE OF ASTEROID HYALITIS*

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Under the name of asteroid hyalitis, Benson,¹ in 1894, described peculiar bodies found in the vitreous and gave them this title because of their resemblance to the stars on a clear night. In this country the same condition has probably been more accurately described and the differentiation from synchysis scintillans emphasized, under the name of snowball opacities of the vitreous. These same bodies have been described by Bachstez²,³ under the title of scintillatio corporis vitrei. The present report concerns the microchemical and histological examination of an eye containing these snowball opacities and associated with chronic glaucoma.

There have been numerous clinical reports concerning these cases, and Vogt included a slit-lamp description of them in his atlas. A report of an examination of these snowball

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