THE BRITISH JOURNAL OF OPHTHALMOLOGY

JULY, 1947

COMMUNICATIONS

FAMILIAL CATARACT WITH EXTENSIVE PEDIGREE CHART *†

BY

I. LLOYD JOHNSTONE

WORCESTER

THE purpose of this paper is to present an interesting and hitherto unreported genealogy of familial cataract, to describe the biomicroscopic features of the cataract and to discuss a few published papers in comparison with the case herein reported. The cataract is not present at birth but has been observed as early as six years and may be as late as thirty, forty or even fifty years of age in showing itself by causing serious loss of vision. Cases of early and late development co-exist so that it is impossible to say that the cataract shows the characteristic of anticipation. Its features are so characteristic that a member of the family possessing the cataract may be identified with certainty on examination of the eyes.

* A paper read before the Midland Ophthalmological Society at Dudley on April 6, 1945, with a few subsequent additions.

† Received for publication, February 4, 1947.

FIG. 1.

The study of the genealogy, extending over the last eleven years, has provided a great deal of human interest. My attention was first drawn to one branch of the family (Fig. 1 A) by the late Bernard Cridland at the Wolverhampton Eye Infirmary where one of the senior members of the family, Miss Clara Attwood (AIII 9), was operated on by him in 1935. Miss Attwood's intimate knowledge of the family history has been of great assistance in preparing the genealogy of this branch of the family. The existence of the other branch was discovered in a rather dramatic way. While several members of the Attwood family were being examined with the slit-lamp, a member of the other branch (J. E. L., B. IV. 4) came into the Out-patient department for removal of a foreign body from the cornea. The nurse on duty, on the watch for such a combination of circumstances, announced that she had a *young man with cataract*. Examination with the slit-lamp made it quite plain that he belonged to the family with this particular and distinctive cataract. A common ancestor could not be established at once, nor could any relations of the same name. Considerable research by J. E. L. eventually established the link. His great-grandfather (B. I. 1) was named Elwell (born 1807). The great-grandmother of generation A.IV. was also an Elwell (born 1815). It is probable that they were cousins but this point has not yet been cleared.

These Elwells of a century ago lived at Sedgley, between Dudley and Wolverhampton. Their descendants are now scattered widely over the Midlands (Wolverhampton, Walsall, Birmingham, Coventry and Northampton), some are in North Wales, some in Monmouthshire, some in London, some in Manchester. Two branches of the family are in the United States of America (Rhode Island) and at least one member migrated to Australia. Many still live in the Dudley-Sedgley area. They are a healthy stock, fairly prolific, and, apart from the peculiar cataract which is the subject of this paper, free from physical and developmental defects. They would rank above average in physical and mental equipment. No consanguinity has been discovered in the genealogy. There is no evidence of calcium deficiency and the blood chemistry and Wassermann reaction are normal in those members of two generations who have been examined. (See note later in this paper for details and exceptions).

Description of the cataract

Distinctive features of the cataract are (a) its presenile onset, (b) its position, primarily posterior, sub-capsular, and therefore saucer-shaped with concavity forwards, thus somewhat resembling cataracta aparathyroidea and ray cataract, (c) its configuration, leaf

or feather-like branches radiating from the centre, thus somewhat like concussion cataract, and (d) flakes and dots in white, yellow, green or blue, throughout the cortex but always separated from the anterior capsule by a sub-capsular clear zone, the zone of disjunction, (e) accentuation of the shagreen of the anterior capsule. The earliest signs observed so far are visible only with the slit-lamp.

FIG. 4.

October, 1935. The narrow beam appearance of the same case as Fig. 3.

The posterior cortex gives a whitish reflex similar to, but less marked than, that found in the later stage. The difference is that no opacity can be detected by ophthalmoscopic examination.

The illustrations, Figs. 2, 3 and 4, will amplify this brief description.

Analysis of the pedigree

Fig. 1 has been divided into two parts, A and B, partly because the connection between the two families has not been established, and partly for convenience. Part A consists of 73 persons, 36 male and 37 female. Of the 73 there are 23 affected, 13 male and 10 female. Part B includes 58 persons, 28 male and 28 female, while the sex of two has not been ascertained. Of the 58, the number known to be affected is 17 (6 male, 11 female).

FIG. 2 (A.III. 14).

October 1935. The cataract is well advanced. The small picture shows the appearance by distant direct ophthalmoscopy. The larger one shows a composite slit-lamp appearance. The denser large opacities are posterior and curved like a saucer. The dots are scattered throughout the lens cortex.

FIG. 3 (A.IV. 17).

October, 1935. This cataract is much less advanced than that in Fig. 2. The central opacity is in the deepest layers of lens cortex, in the position shown by the interrupted white line in Fig. 4. The radiating spokes are at the same depth.

FIG. 5. (A.III. 16).

October, 1935. A peculiar pitted appearance of the central area of the retina. The round marks appear like depressions and have no resemblance to colloid or other forms of degeneration.

FIG. 6.

The same eye as Fig. 5, but the drawing was made in June, 1945, when the appearance was that of "Doyme's honey-comb choroiditis."

The affected persons in Part A are 31.5 per cent. of the total, in Part B 29.3 per cent. In Part A there is a slight preponderance of males among the affected members; in Part B the affected females are nearly twice as numerous as affected males. There is no particular significance in these relative figures. What is significant is that inheritance is through either sex and through affected members only. It is therefore a Mendelian dominant characteristic. Forty-one members of the family have been examined by the writer, the majority in the years 1935 and 1936. Several have been seen periodically during the last ten years and a number of these have had one or both cataracts removed during that time.

The members of the family may now be dealt with seriatim, beginning with Part A.

A.I. 1-3. Michael and Joseph Elwell were known to have had cataracts removed. Sarah (Elwell) Hedges knew that it was hereditary. She also had her cataracts removed. She was born in 1815 and died in 1892 and is well remembered by her living grandchildren.

II. 1 and III. 1, 2. Charles. Had operation. Migrated to America. Whether his two children were affected and whether they have children is not known at present.

II. 2 and III. 3, 4. Martha—unaffected and her children unaffected so far as symptoms go (not examined).

II. 3. Mary. Unmarried. Cataracts removed.

II. 4 and III. 5, 6. Unaffected and living in America.

II. 5. Phoebe Attwood (née Hedges). Cataracts removed. Was perturbed because her children were affected. Some remained single for that reason. Of her ten children eight are affected.

II. 6. David. Died nearly 70 years of age. His doctor said he had cataract but he did not have an operation. Possibly his was senile cataract. None of his children or grand-children is known to be affected. Five have been examined by the writer.

II. 7. Harry. Not affected, nor are his son or two grandsons (not examined).

II. 8. and III. 24. Unaffected and living in America (Rhode Island).

II. 9. Sarah. Unaffected. Did not marry.

III. 7. Harry Attwood. Operated. All his five children affected. The two youngest have the earliest signs yet observed, visible only with slit-lamp.

III. 8. Jessie. Unaffected and her children unaffected.

III. 9. Clara. Unmarried. Giddiness on wearing cataract glass after operation. Difficulty disappeared after gall bladder operation.

III. 14. Sidney. Operation by G. F. Haycraft 1936. Was able to work till the cataracts were far advanced (Fig. 2).

III. 16. Ada. Unmarried. Unaffected. Had a very unusual fundus abnormality. In 1935 the central area of the retina had the appearance of numerous small round depressions as if it had been struck by pellets from a shot gun, or they may have been elevations like bubbles. The colour was that of normal retina. (Fig. 5). In April, 1945, the condition had quite altered. It is not unlike Doyne's familial honeycomb choroiditis (Fig. 6).

IV. 3. Frank, aged 32 years. Served in recent war but was discharged on account of failing vision. Left cataract removed in 1943. Right developed rapidly and was removed in 1945.

IV. 4, 5. Florence and Miriam. No ophthalmoscopic sign of cataract but the posterior cortex reflects the slit-lamp beam as effectively as a developed opacity. The glow is white.

IV. 7. Not affected. Has blue sclerotics and hare lip.

IV. 10. Right cataract removed in 1944, left in 1946.

IV. 12. One cataract (? left), removed at Northampton 1942.

IV. 13-15. V. 4, 5. All living at Newport, Mon. and not examined.

IV. 17. George Attwood, aged 27 years. Affected. There has been but slight advance in his cataracts in the last ten years (Figs. 3 and 4).

V. 2, 3. These two children developed maculo-cerebral degeneration and are the subjects of a previous report (Johnstone, 1938). The elder died in February, 1943, aged 18 years. The younger died in December, 1945, aged 19 years.

PART B

B.I. 1. Benjamin Elwell, born 1807. Had one cataract removed and lost the eye. Refused operation on the other eye. His grandson (III. 10), used to lead him about Sedgley streets. His relationship to his contemporary Elwells (A.I. 1-3) has not been established, possibly cousins.

II. 5. Elizabeth Williams (née Elwell). Herself and five of her eleven children affected.

III. 10. Benjamin Russell. Belongs to an unaffected branch. His knowledge of the family has been invaluable in the investigation. He was interviewed in 1938. No attempt was made to chart the unaffected branch of the family any further than his generation as the members were somewhat scattered, many of them dead, and he knew of no cataract among them.

III. 14, 15. Both affected and both died without issue.

III. 16. IV. 1. Cataracts removed at Manchester.

III. 18. Louisa Lowndes (née Williams). Herself and four of her five children affected.

IV. 4. Joseph Lowndes, aged 45 years. Left cataract extracted by Bernard Cridland in 1931, the right by the writer 1942. Passed A.1 for Army in 1916, obtained marksman's proficiency at musketry and went overseas in October, 1916. Became a mustard gas casualty on November 9, 1918, but no after-effects. His interest and co-operation have made the investigation of Part B of the family possible. He is still following every available opportunity to extend his knowledge of the family. He is a skilled workman and foreman in the engineering trade and apparently was not

FIG. 7.

Subjective appearance in the eyepiece of a microscope drawn by Joseph Lowndes (B.IV. 4) R. cataract. L. aphakia with some capsule remnants. A vitreous opacity is shown in the upper part of field. Drawn June, 1941, a year before right cataract extension.

handicapped while using one aphakic eye during at least seven years when the right cataract was developing. In 1941 he prepared a drawing showing the shadow of his right cataract seen subjectively when looking into a microscope (Fig. 7). With it is shown the shadow from capsule in his left eye and also a vitreous opacity.

IV. 5. Beatrice. Both eyes operated on in 1918 by Bernard Cridland.

IV. 6. May. Awaiting operation now.

IV. 7. Harry, aged 39 years. Left extraction by Bernard Cridland about 1914, right by the writer in 1945.

V. 2. Dennis, aged 19 years. Both cataracts extracted by the writer.

V. 5. Gordon Stones. 1937 (aged 9 years) no sign of cataract. 1945 early signs present with posterior reflex and a few flakes.

V. 6. Graham, aged 6 years. Examined January, 1945. Left cataract with feathery posterior pattern and many scattered dots. Right less advanced.

V. 7. Vivienne (born March 15, 1943). No obvious opacity. Examined without mydriatic and without slit-lamp.

TABLE I

	Date of Test	Serum Calcium	Serum Cholesterol	Serum Phosphorus	Serum Protein		
					Total	Albumin	Globulin
Normal	—	9-11	100-200	2-4	5-8	3-5	1-2.5
A III 9	Sept. 1946	8.1	227	—	—	—	—
A IV 3	Sept. 1945	10.0	not done	not done	7.96	5.67	2.29
A IV 10	Aug. 1946	7.14	262	3.9	—	—	—
A IV 17	April 1946	12.0	80	3.6	8.46	5.86	2.60
B IV 7	June 1945	12.0	65	3.2	7.30	3.41	3.79
B V 2	April 1946	12.0	65	3.6	7.10	5.67	1.43
A. L.	Sept. 1946	10.2	174	2.7	—	—	—
E. G.	July 1946	11.4	174	—	—	—	—

All figures are given in mg. per cent.

In Table I the summary is given of all blood estimations so far carried out. They have all been done in the last two years and the number is still small. The last two cases, A. L. and E. G., have familial cataract but do not live in the Dudley area and their connection with the main pedigree has not been traced. Serum cholesterol varies considerably in the series—two are above, three below and two are within normal limits. In the case of calcium, four are above, two slightly below and two within normal. The serum phosphorus and protein are normal in all the cases in which they were estimated.

Discussion of some published papers

In the first decade of this century, particularly from 1906 to 1910, much interest was shown in the genetics of transmissible eye defects. Nettleship and Ogilvie (1906) published the pedigree

of the Coppock family of Headington Quarry, Oxford. This family and cataract are widely known to ophthalmologists, having been discovered by Doyne in 1888 at the Oxford Eye Hospital. Adams continued Doyne's interest in the family so that few who have taken the course for the Oxford Diploma in Ophthalmology or attended the Oxford Congress, can fail to have some acquaintance with the "Coppock cataract," or "Doyne's discoid cataract." Adams (1942) has brought the story up to date with a description of the slit-lamp appearance. A point of minor interest in Nettleship and Ogilvie's paper (1906) is that the obtaining of the full genealogy of the Coppock family was entrusted to the Vicar of Headington Quarry, Johnstone by name. Doyne's discoid cataract is quite definitely congenital, the opacity involving some part of the lens nucleus and being present at birth. It is transmitted as a Mendelian dominant.

Nettleship (1909) published seven more genealogies of cataract, one of which was congenital (Case 1, Everett), one was senile (Case 4), three were possibly familial (Case 2, Perrin), (Case 3, Tomes), (Case 6, Deasley), and two were very likely familial (Case 5, Hiblen), (Case 7, Oldfield). The same author (1912) published a further case of presenile cataract.

Coming to more recent literature on the subject—Veil and Favoury (1930) present a case of probable Mendelian dominant inheritance. The pedigree is far from complete and the cataract is described as "*cataracte nucléo-corticale postérieure nummulaire avec disques stratifiés, entourés d'un halo poussiéreux.*" Like the subject of this paper, there is accentuation of the anterior capsule shagreen, some dots in the anterior cortex and the main opacity is posterior, but there the similarity ends. The chief opacity is from behind the foetal nucleus into the posterior cortex. It presents a stratified structure in concentric lamellae, indented and fitting into one another, the whole resembling a piece of money centred on the axis of the lens. It is surrounded by a ring of dust-like opacity affecting the posterior capsule, the periphery of which is transparent.

Weill and Nordmann (1930) have collected a series of six cases of endocrine disturbance with lens opacities. They divide them into two groups, (a) posterior saucer-shaped and (b) punctate and flocculent. In the first group there are three cases. Two are due to parathyroid deficiency and agree with this condition. One is a severe case of diabetes, aged 38 years. There are fine dots and some red and green crystals at the anterior surface of disjunction in addition to the posterior "*cataracte en soucoupe.*" The description suggests the picture of the cataract of this paper but the drawings are not like it at all. In group (b) two cases of myotonic

dystrophy present features resembling the present series more nearly. The third case has all the appearance of a lamellar cataract with riders; serum calcium below normal, Chvostek's sign positive and history of convulsions at age two. There is nothing in the genealogy of this present report to compare with the endocrine disorders of the six cases above.

Two papers by Caughey (1933) and Souter (1933) deal with cataract in dystrophia myotonica. The cataract in these cases has much in common with the cataract in this paper but my cases have no suggestion of muscular dystrophy or endocrine disorder. For a fuller appreciation of cataract in myotonic dystrophy the reader is referred to the above papers and to articles by Adie and Greenfield (1923) and Goulden (1928), quoted by these authors.

The purpose in referring to these cases from the literature is to draw attention to the points of similarity between cataracts associated with endocrine and metabolic disorders and my own cases without such disorders. When more is known about genetics and about endocrinology it may be this similarity will be explicable. For the present there seems to me no alternative to the view that the cataract of this paper is an hereditary feature transmitted by an autosome. As such it is not a defect or degenerative tendency on the part of the lens or the endocrine glands, but a true inherited feature. It is not apparent at birth and so cannot be called congenital. It will resemble the affected parent later on if the infant has the autosome bearing the characteristic. It may be compared with a distinctive type of nose, for example. At birth and in infancy the nose is like any other baby's nose, but as the child grows up and approaches maturity the nose develops the parental type and the similarity is easily recognised. We may say it is a familial, an inherited characteristic, but not a congenital one.

There is one more paper to which reference must be made. Hornback and De Garis (1933) give a pedigree made up of 59 persons in four generations of whom 30 had cataract, 14 male and 16 female. The unusual feature is that two males in generation II appear to have transmitted the cataract without themselves being affected. The authors rightly argue that the inheritance is an autosomal one, and dominant. To explain how an unaffected parent could have affected offspring they postulate a dominant autosomal gene which is atypical in that it produces its effect (cataract) only under certain conditions. There seems one fatal weakness in their line of argument. They produce no evidence that the two males in question didn't have cataract, beyond the fact that they were not operated on or left no history of faulty vision. Evidence of absence of cataract in the light of present day knowledge could be accepted only after examination with the slit-lamp

and corneal microscope. From my experience familial cataract may be present for many years without the affected person having any suspicion of it. The age at which it begins to interfere with normal work and activity depends upon whether a clear space remains in or very near the visual axis or not. Some cases have been able to go on working and reading till a marked degree of opacity is visible with the ophthalmoscope; a few are in difficulty when the opacity is comparatively small but more obstructive to direct vision. The cataract is never so visible to the casual observer as a mature senile cataract. A medical practitioner may well be excused for not being able to tell if the cataract is present in the early stages. Ophthalmic surgeons may miss the cause of failing vision in young people, as actually happened with two of the members of the family herein reported. In my opinion the view that some other factors, possibly nutritional or endocrine, predispose to the realisation of the hereditary characteristic (cataract) is not proven. The "carriers" may have had the defect.

Further study of blood chemistry and endocrine activity may throw important light on all forms of cataract including the senile variety. The case for straightforward inheritance may be strengthened, or it may diminish and even disappear in the light of new knowledge in endocrinology and biochemistry.

Summary

An extensive new pedigree of familial cataract with Mendelian dominant method of inheritance is presented and the biomicroscopic appearance of the cataract is described. The possibility of other causal factors is discussed with the help of a review of the relevant literature, and a small series of blood analyses is presented.

Acknowledgments. I am indebted to the Wolverhampton Eye Infirmary for facilities to carry out the first year of the investigation and to Mr. H. B. Salt, M.Sc., of the Pathological Service, Worcester Royal Infirmary, for the blood analyses, by kind permission of Dr. McMenemey.

REFERENCES

- ADAMS, P. H. (1942).—*Brit. J. Ophthalm.*, Vol. XXVI, p. 152.
 ADIE, W. J. and GREENFIELD, J. G. (1923).—*Brain*, XLVI, p. 73.
 CAUGHEY, J. E. (1933).—*Trans. Ophthalm. Soc. U.K.*, Vol. LIII, p. 60.
 GOULDEN, C. B. (1928).—*Trans. Ophthalm. Soc. U.K.*, Vol. XLVIII, p. 97.
 HORNBACK, E. T. and DE GARIS, C. F. (1933).—*Jl. Morphol.*, Vol. LIV, p. 347.
 JOHNSTONE, I. LLOYD—(1938).—*Trans. Ophthalm. Soc. U.K.*, Vol. LVIII, p. 769.
 NETTLESHIP, E. (1909).—*Trans. Ophthalm. Soc. U.K.*, Vol. XXIX, p. 188.
 ——— (1912).—*Trans. Ophthalm. Soc. U.K.*, Vol. XXXII, p. 337.
 NETTLESHIP, E. and OGILVIE, F. M. (1906).—*Trans. Ophthalm. Soc. U.K.*, Vol. XXVI, p. 191.
 SOUTER, W. C. (1933).—*Trans. Ophthalm. Soc. U.K.*, Vol. LIII, p. 73.
 VEIL, P. and FAVOURY, A. (1930).—*Bull. et Mem. Soc. Franç. d'Ophtal.*, Vol. XLIII, p. 11.
 WEILL, G. and NORDMANN, J. (1930).—*Bull. et Mem. Soc. Franç. Ophtal.*, Vol. XLIII, p. 17.