CONGENITAL CATARACT FOLLOWING GERMAN MEASLES IN THE MOTHER.

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In the first half of the year, 1941, an unusual number of cases of congenital cataract made their appearance in Sydney. Cases of similar type, which appeared during the same period, have since been reported from widely separated parts of Australia. Their frequency, unusual characteristics and wide distribution warranted closer investigation, and this report is an attempt to bring to notice some of the more important features of what might almost be regarded as a mild epidemic.

I am indebted to many of my colleagues in New South Wales, Victoria and Queensland for particulars of very many of the cases reviewed. These, for the most part, conform very closely to the general features noted in my own series of cases on which the following description is based. The total number of cases included in this review is seventy-eight. My own cases total thirteen, and in addition I have seen seven others included in my colleagues' lists.

General Description and Special Features.

The first striking factor is that the cataracts, usually bilateral, were obvious from birth as dense white opacities completely occupying the pupillary area. Most of the babies were of small size, ill nourished and difficult to feed, with the result that many of them came under the care of the pædiatrician before being seen by the ophthalmic surgeon. Many of them were found to be suffering from a congenital defect of the heart—a fact which, as will be explained later, has adversely affected full investigation of the condition of the lens and in some cases the treatment. The pupillary reaction to light was weak and sluggish; in some cases the irides had a somewhat atrophic appearance. This was more noticeable after mydriasis when the pupillary border appeared as a flat dark band seemingly devoid of any iris stroma.

Full mydriasis was difficult to obtain; in my experience it varied from one-half to three-quarters of the normal; moreover, an unusual number of the patients showed intolerance to atropine. In a large proportion of the cases one was forced to rely upon repeated instillations of homatropine to maintain the mydriasis.

Cataract.—In the undilated condition of the pupil the opacities filled the entire area. After dilatation the opacities appeared densely white—sometimes quite pearly—in the central area with a small, apparently clear, zone between this and the pupillary border of the iris. Closer examination revealed in this zone a less dense opacity of smoky appearance, and outside this only a narrow ring through which a red reflex could be obtained.

The cataractous process seemed to have involved all but the outermost layers of the lens, and was considered to have begun early in the life of the embryo. Generally the cataract was symmetrically situated, but in a few

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cases it was somewhat excentric—in these there was some sparing of more of the fibres in the lower portion of the peripheral zone. Although the general appearance was much the same in all cases, two main types were noticed in the character of the cataract. In one the contrast between the larger dense white central area and the smaller cloudy more peripheral zone was very marked. In the other the density of the cataract was more uniform throughout and occupied an intermediate stage between that of the two portions of the other type. This distinction has been confirmed by the immediate results of operation. When needling was undertaken in cases of the first group, the dense white central portion was difficult to divide and sometimes separated off as a firm white disk. In others the whole lens seemed to be pushed away by the needle. Subsequent absorption in this group was delayed.

In the second type discission was easier to perform and absorption regular and uniformly progressive. In one case under my care both these types were present, the first type in the right eye and the second type in the left eye. In my opinion these variations and those described by other observers are not essentially different from each other, and the apparent differences are due merely to a variation in intensity and duration of action of the same noxious factor.

The appearance of the cataract does not, in my opinion, exactly correspond to any of the large number of morphological types of congenital and developmental lenticular opacities that have been described. I do not wish to add to what Duke Elder[1] has described as "the confusion which has arisen from the enthusiasm of various observers in the multiplication of types which differ but little in their essential pathology and vary only in their shape and position". I shall, therefore, merely describe the cataract as subtotal. Other descriptions by my colleagues in notes on their cases have been: central nuclear, complete, discoid, nuclear plus, anterior polar, dense central with riders, complete pearly, mature, and total lamellar. In sixteen cases of the whole series reviewed the cataract was unilateral.

Vision.—In all cases the response to light was good; the babies appeared to follow readily any movement of the light stimulus.

Nystagmus.—In the very young patients nystagmus was not noted, but in older babies or in cases in which treatment had to be delayed it was present. The movements were of a coarse, jerky, purposeless nature rather than a true nystagmus. It was a searching movement of the eyeballs and indicated the absence of any development of fixation. In my own cases it was always present if treatment had been delayed beyond the age of three months. In one case, in which the parents deferred operation in order to try some other form of treatment of which they had been informed, it developed before they consented to operation. In another case it developed after operation during the process of absorption. This development during the waiting period before operation has been noticed by other observers.

Variations.—One case in my series was particularly interesting. The baby was referred to me at the age of three weeks with a diagnosis of bilateral keratitis. The corneæ were quite white at birth and both parents had been subjected to a Wassermann test with negative results. At examination I noted a peculiar corneal haze, denser in the centre than in the periphery. The iris was just visible through this haze in the peripheral zone. The

tension was normal and there was no inflammation. I advised reexamination under anæsthesia. This was done two weeks later. By this time the corneæ had cleared and the typical white cataracts were seen in the pupillary areas. This baby subsequently became very ill and it was only a few weeks ago that I was able to operate. At operation mydriasis was fuller than usual in these cases and the cataracts were the largest observed in this series.

Two other cases with similar corneal involvement have been noted—namely, by A. Odillo Maher and H. E. Robinson. Involvement was unilateral in Maher's and bilateral in Robinson's case. In these cases there had apparently been some temporary interference with the nutrition of the cornea. Maher's case is also interesting in that the mother developed cataract during pregnancy at the age of twenty-seven. This is the only instance throughout the series of any familial history of cataract.

In another case, reported by S. R. Gerstman, there was "bilateral subluxation of the lenses, mature cataracts, accompanied by arachnodactyly and large fontanelle. Hip regions appeared normal."

Other complications reported have been cleft palate, one; congenital stenosis of naso-lachrymal duct, three; *calcaneus varus,* one; although it is not certain whether these are above the average incidence in any group of infants of similar numbers.

Monocular Cases.—The monocular cases merit special consideration. Sixteen of these have been reported, and in ten of them definite microphthalmia has been described.

In one of my cases—there were three in all—the cataract was noted by the mother only when the child was seven weeks old, though she stated that it may have been present before that date. The affected eye was definitely microphthalmic, and examination of the other eye under mydriasis revealed a large pale area with some scattered pigmentation in the lower half of the fundus suggestive of a coloboma.

In another case the mother gave a history that both eyes were said to have had conjunctivitis at birth. This inflammation, she stated, cleared up under treatment in three weeks, and then two weeks later she noticed a white mass in the left pupil. Conceding the accuracy of these histories, I have no doubt that the cataracts were present at birth in the central portion of the lens and that it was the final opacification of the more peripheral fibres which made them apparent. In all other cases the cataracts have been apparent from birth.

Reporting her case of left-sided monocular cataract, Dr. Aileen Mitchell wrote:

> No difference was noticed in the size of the eyes when the child was seven weeks old; when the child was aged four months there was microphthalmia of the left eye. The mother said the eye had got small. Diameter of the right cornea was about 11 millimetres, of the left cornea 8·5 millimetres. Nystagmus, which was not present at the first examination, had developed and was coarse in nature with roving movements of the eyeballs. The fundus of the right eye appeared pale, and some scattered irregular shaped spots of pigment were observed.

L. Stanton Cook described one case, monocular central opacity of the lens, and writes: "It would appear that this cataract is a developmental defect rather than a toxic type." As the baby also had the typical congenital defect of the heart, I feel that this is open to question.

The accompanying microphthalmia, definitely noted in 66% of cases, suggests an inhibitory effect on the development of the eye generally. In an autopsy performed in a monocular case at the Royal Alexandra Hospital for Children the following measurements were recorded: Left eye (affected), antero-posterior diameter, 1·6 centimetres; transverse diameter, 1·5 centimetres. Right eye (unaffected), these measurements were respectively 1·8 centimetres and 1·9 centimetres. It was also noted that the left cornea was smaller than the right in proportion to the general variation in size of the eyes.

Microphthalmia.—Microphthalmia is present so frequently (66%) in the cases of monocular cataract that closer attention to the size of the eyes in the binocular cases is advisable. Is it not possible that both eyes may be smaller than normal, and that this feature may be unnoticed because it is bilateral? Further information on this aspect can be obtained from measurements at autopsies and by observation of the subsequent growth of the eyes in the living infants. In this respect the following measurements obtained at autopsies in other cases at Royal Alexandra Hospital for Children are interesting:

B.S., *ætatis* five months. Right eye: antero-posterior diameter, 1·5 centimetres; transverse, 1·7 centimetres. Left eye: antero-posterior diameter, 1·4 centimetres; transverse, 1·7 centimetres.

M.M., *ætatis* three months. Right eye: antero-posterior diameter, 1·5 centimetres; transverse, 1·5 centimetres. Left eye: antero-posterior diameter, 1·6 centimetres; transverse, 1·6 centimetres.

M.O'S., *ætatis* five and a half months. Both eyes: antero-posterior diameter, 1·6 centimetres; transverse, 1·8 centimetres.

J. Maude described one case as "bilateral microphthalmos, right eye smaller". According to Scammon and Armstrong,[2] the average measurements of the eyeball at birth are: sagittal diameter, 17·6 millimetres; transverse diameter, 17·1 millimetres; vertical diameter, 16·5 millimetres. Postnatal growth is very small in the first six months, but they stated that it is most probable that the figures for this period are too low because of the inclusion of premature cases.

By comparison with these average measurements of the normal eye at birth the figures quoted above show a definite diminution in the antero-posterior diameter and a reversal of the normal relationship between the respective lengths of the antero-posterior and transverse diameters.

In the cases under consideration here it must be remembered that many of the babies are generally undersized, so that any estimation of the size of the eyes must be considered in relation to the general size and body weight of the baby.

Heart.—As previously mentioned, an extremely high percentage of these babies had a congenital defect of the heart. I am indebted to Dr. Margaret Harper for the following description of eight cases seen by her:

All these babies were seen because of difficulty in feeding and failure to thrive. They all had symptoms suggesting a cardiac defect such as difficulty in taking the breast; they had to be fed in their cots by bottle and some by gavage. They were all in the acyanotic or potentially cyanotic groups of cardiac defects. None was cyanotic. There was a harsh systolic murmur over the base of the heart and down the sternum in all. Some had a thrill. All had signs suggesting the continuance of a fœtal condition or of a malformation of the heart.

In my own series this condition was present in all but one case. In the whole series it has been present in forty-four cases; in eleven cases there is no record of the cardiac condition; in ten cases it has been recorded as normal or apparently normal; in four cases in which the condition was not reported upon, the babies died and death was sudden; in another the baby was "ill nourished"; and in three cases the report was "no defect noted".

Autopsy in three cases at the Royal Alexandra Hospital for Children revealed a wide patency of the *ductus arteriosus,* and I understand that in autopsies performed elsewhere a similar condition has been found. The reports on the cardiac condition from autopsies in three cases at the Royal Alexandra Hospital for Children are as follows:

M.O'S.: There was hypertrophy of the ventricular muscle; the left measured 0·9 centimetre and the right 0·5 centimetre. A few petechial hæmorrhages were detected on the surface of the myocardium. The endocardium and valves were normal and all the septa intact. The *ductus arteriosus*, however, was widely patent.

B.S.: There was no free fluid in the pericardial sac. The heart was enlarged, with particular hypertrophy of the right ventricle. Right ventricle measured 0·7 centimetre and the left 0·8 centimetre. There were a few petechial hæmorrhages visible on the surface of the myocardium and one fairly large "milk spot". The membranous portion of the interventricular septum was patent. The *foramen ovale* was not completely occluded, although it appeared to have been functionally closed. The heart valves and great vessels were normal, but the *ductus arteriosus* was widely patent.

P.F.: The right heart was somewhat dilated. The right ventricle wall was 0·35 centimetre in its thickest part. The left ventricle wall was 0·5 centimetre in its thickest part. All valves were normal. No septal defect was present. Vessels were normal except for a wide patency of the *ductus arteriosus.*

Additional Findings.—In one case at the Royal Alexandra Hospital for Children there were several additional findings worth record here.

Both lungs had a considerable degree of hypostatic congestion at the bases. Throughout the remainder of the lungs there were a very large number of hæmorrhagic spots, some of which were confluent and covered considerable areas. Hæmorrhagic spots were detected on the inner surface of the pericardium and on the surface of the myocardium. In addition, the visceral pericardium over the upper anterior aspect of the left ventricle bore a "milk spot". The right kidney was situated in such a position that the ureter entered the pelvis on the lateral side of the kidney after coursing across its anterior surface. The right kidney consisted of two distinct lobes, the upper one about twice as large as the lower. Each lobe had its own separate pelvis, and the ureter divided outside the kidney into two branches, one to each lobe. Both ovaries were cystic. The uterus was bicornuate in type.

Another complication noted in a few cases was the development of a dry scaly eczematous condition, involving the face, scalp and limbs, which was very resistant to treatment.

Sex.—Thirty-three of the patients were males, thirty-five were females. In the remaining ten cases the reports did not specify the sex of the child.

Deaths.—In this series of cases fifteen deaths have been recorded. Details are not available in all cases of the mode or cause of death, but broncho-pneumonia has been noted in several. In three cases within my own knowledge there has been a sudden rise of temperature up to 105° F. or even 106° F., accompanied by extreme distress, and death has followed within twenty-four hours.

Intolerance to Atropine.—Intolerance to atropine has been a noticeable feature of the cases in my own series and in no single instance has it been possible to continue its administration throughout the treatment. In most

cases, even after one or two instillations, the baby has exhibited considerable constitutional disturbance with pyrexia, restlessness and irritability, and the difficulty of feeding has been intensified. In one case in which two instillations were made over a period of twenty-four hours, the temperature rose to 105° F. Homatropine, 2%, was substituted and the temperature returned to normal, and was not subsequently elevated. Other observers have noted the same intolerance to atropine.

ÆTIOLOGY.

Although one was struck with the unusual appearance of the cataracts in the first few cases, it was only when other similar cases continued to appear that serious thought was given to their causation.

The remarkable similarity of the opacities in the lens, the frequency of an accompanying affection of the heart and the widespread geographical incidence of the cases suggested that there was some common factor in the production of the diseased condition, and suggested it was the result of some constitutional condition of toxic or infective nature rather than of a purely development defect.

The question arose whether this factor could have been some disease or infection occurring in the mother during pregnancy which had then interfered with the developing cells of the lens. By a calculation from the date of the birth of the baby it was estimated that the early period of pregnancy corresponded with the period of maximum intensity of the very widespread and severe epidemic in 1940 of the so-called German measles.

Special attention was accordingly paid to the history of the health of the mothers during pregnancy, and in each new case it was found that the mother had suffered from that disease early in her pregnancy, most frequently in the first or second month. In some cases she had not at that time yet realized that she was pregnant.

The investigation was then repeated in the early cases in which such a history had not been sought, and again the history of early "German measles" infection was definite. Moreover, in all these cases the health of the mother during the remainder of the pregnancy was described as good.

As the constant involvement of the central nuclear fibres in the cataractous process suggested an early incidence of the noxious factor, it was considered that a possible solution of the problem had been obtained. Confirmation for this theory was therefore sought from any of my colleagues who had seen lesions of this type, and they kindly agreed to assist me by inquiry into the health of the mothers during pregnancy. The result of their inquiries confirmed the amazing frequency of the "German measles" infection.

"Congenital cataract may be due to a maldevelopment, a physical or chemical element acting on the developing lens, or inflammation during the embryonic or fœtal period."[3]

Duke Elder[4] stated: "The ætiology of these opacities depends upon some disturbances of the development of the lens, but what the actual disturbance may be, or the precise method of its action, is a matter of considerable doubt in most cases."

From his anatomical studies Jaensch[5] (1924) concluded that an intrauterine inflammation was a frequent cause of a total opacity of the lens. Toxic influences also may play a part in the production of opacities, and it is

conceivable, writes Duke Elder,[6] that toxic or infective processes in the mother may cause a derangement in the lens of the fœtus, or that similar causes, error of feeding and nutrition or acute exanthemata in the infant, may have a similar effect.

Ida Mann[7] has stated that the exanthemata, measles, mumps, smallpox, chickenpox, scarlet fever *et cetera,* are all known to be transmissible transplacentally.

Whatever the disturbing factor may be, it is fair to assume that the earlier it acts, the more will the central portion of the lens be likely to suffer.

In the developing lens, in the 26-millimetre stage of the embryo, the original central primitive fibres, elongations of the cells of the posterior wall, have completed their growth. Then begins the development of the secondary lens fibres from the cells in the equatorial region. All subsequent growth in the lens is from these equatorial cells, which give rise to successive layers of new lens fibres, these fibres enveloping and compressing the central fibres. With the development of these fibres comes the appearance of the suturing which eventually takes on the typical "Y" pattern of the fœtal nucleus.

In the cases under review the cataractous process has involved these early fibres. Can we not fairly assume that the morbid influence began early? As successive layers of fibres were also affected, until the greater part of the lens became involved, this noxious factor must also have persisted in diminishing strength until finally with its disappearance some normal fibres were formed.

Just how and where this disturbance took place I cannot say. Much more histological evidence than is at present available will have to be obtained before any suggestions can be made. However, if we allow the possibility that the lens may be affected by infective processes in the mother, and if we find the same infection occurring at approximately the same early period in the pregnancy in almost all the cases, and if we then find that the babies of these mothers have cataracts of a more or less uniform type which involve the fibres formed at that period, then I think it is reasonable to assume that the occurrence cannot be a mere coincidence, but that there must be some definite connexion between that infection and the morbid condition of the lens.

Although it is rare, cases of the exanthemata have been seen in the newborn baby. Ballantyne[8] noted twenty recorded examples of fœtal measles up to 1893; whilst up to 1902 not more than twenty well authenticated cases of scarlet fever in the fœtus had been recorded, varicella *in utero* was not unknown.

The remarkable frequency of the accompanying congenital defect of the heart and the apparent constancy in type of this defect seem to me to indicate a common causative factor. Could this not be some toxic or infective process resulting in a partial arrest of development?

INCIDENCE OF GERMAN MEASLES IN THIS SERIES.

In all but ten cases in this series the history of "German measles" infection is present. In two of these ten cases the report is negative for measles; in one there was "history of kidney trouble"; in two others the report is definitely "history not asked for"; in the remaining five cases the

report is "no history of measles" or "not known". It is interesting to note that the majority of these were cases occurring in 1940 or early in 1941 before the theory of a possible association between "German measles" and the congenital cataracts was promulgated.

Amongst the cases that have come under my own notice in only one is the history negative. In this case the mother stated that she was kept so busy looking after her ten children that she could not recollect any details of her own health beyond the fact that she was ill at about the sixth week of pregnancy when one of the other children died suddenly from whooping cough. Even though she was ill, she was unable to go to bed during the last month before the baby was born one month before full term. In the vast majority of the cases infection occurred either in the first or second month of pregnancy. In a few cases it was during the third month, and in one it is reported as a severe attack occurring three months before pregnancy.

This maternal infection occurred in July or August, 1940, in the majority of cases; in the minority of cases outside this period the date of infection ranged from December, 1939, to January, 1941.

Out of thirty-five cases in which the record is available, the affected baby was the first child in twenty-six instances; in three others it was a second child; whilst in the six remaining cases the baby was the third, fourth, fifth, seventh, eighth and tenth child respecively. I believe that these figures, with the noticeably high incidence in the children of *primiparæ*, afford confirmatory evidence of the close association between congenital cataract in the baby and the maternal infection. For it was this young adult group, to which these *primiparæ* belong, which was particularly affected by this epidemic of "German measles".

GEOGRAPHICAL DISTRIBUTION.

Although the majority of the cases reported came from the suburban districts of Sydney and Melbourne, others were from widely separated country towns in New South Wales and Victoria, and eight were from Queensland distributed between Brisbane, Rockhampton and Ipswich.

NATURE OF EPIDEMIC.

Within my own experience I have not previously seen German measles of such severity and accompanied by such severe complications as occurred during this epidemic in 1940. The swelling of the glands of the neck, the sore throat, the involvement of the wrist and ankle joints and the general constitutional disturbance were all very pronounced. The average stay in hospital of patients treated at the Prince Henry Hospital was eight days as against four days in previous years.

The peak period of the epidemic from returns at this hospital was from mid-June to early August.

Running concurrently with this epidemic were the epidemics of sore throat known as the Ingleburn throat or Puckapunyal throat *et cetera*, deriving its name from the military camp with which it was associated. These epidemics started in the camps and spread to the civilian population. Could they not have been streptococcal in origin and is it not possible that the rash diagnosed as "German measles" may have been, in some cases, a toxic erythema accompanying a streptococcal infection?

In this respect it is interesting to note that the rash occurring in this so-called "German measles" epidemic has been described to me by physicians as macular, morbilliform, scarlatiniform and toxic erythematous; in other words, it was pleomorphic. I have also been informed by two physicians that they have at present an unusual number of young adult patients suffering from arthritis and other rheumatic conditions, and these patients all have a history of "German measles" last year. Because "German measles" is not a notifiable disease it is impossible to obtain any details of the epidemic from the health authorities, but from my own observations and inquiries I have formed the opinion that the 1940 "German measles" epidemic differed greatly from the ordinary virus infection bearing that name.

MANAGEMENT.

From the purely ocular standpoint the essential consideration is the same as in cases of the ordinary lamellar type of cataract—to permit sufficient light stimulus to reach the retina so that fixation may be developed. In this respect the time factor is of the utmost importance. If the stimulus is insufficient or delayed, nystagmus will result.

The special considerations in this series are: (*a*) the marked density and large size of the opacity; (*b*) the difficulty in obtaining mydriasis, so that the transparent area for entrance of light is minimal; (*c*) the high frequency of intolerance to atropine.

These factors compel us to operate at the earliest possible moment. In my opinion the only contraindication to early interference is the general state of health of the baby. In many cases this has been so bad that physicians have refused to give an anæsthetic until some improvement has been obtained in the general condition. So frequently has nystagmus been observed to develop during this waiting period that I am convinced that some risk is justified in order to operate at the earliest possible moment, particularly as later experience has shown that the babies take the short anæsthetic required more easily than had been anticipated.

When operation has to be deferred it is essential to maintain the fullest possible degree of mydriasis, by atropine if tolerated. If atropine cannot be employed, then repeated instillation of homatropine must be substituted for it.

The value of early operation is well illustrated by one case reported by E. Temple Smith in which he performed discission on a baby aged three weeks. Clear pupils resulted and there has been no sign of nystagmus developing.

Operation.

Discission has frequently proved more difficult than usual. The anterior chamber is particularly shallow, and in many cases the very dense central portion of the lens has proved very resistant to the needle. Sometimes it has separated off as a firm disk, in others the whole lens has tended to move away from the point of the needle, and one has obtained the impression that it would have been possible to perform an ordinary extraction. In other cases, on the other hand, discission has been straightforward and easy.

Results of Operation.—Absorption has been slower than that of the ordinary lamellar cataracts. I have not yet had an opportunity to examine

the fundi of any patient after absorption of the lens matter, but I propose to do so in as many cases as possible under general anæsthesia. Careful search will be made for any other defects. The unhealthy appearance of the iris in some cases suggests that there may be possibly some changes in the choroid, particularly since the patients in the monocular cases are so frequently microphthalmic.

PROGNOSIS.

It is difficult to forecast the future for these unfortunate babies. We cannot at this stage be sure that there are not other defects present which are not evident now but which may show up as development proceeds. The cardiac condition also tends to make the prognosis doubtful. One baby which had survived two operations some months ago, suddenly died quite recently at the age of seven months. The possibility of the appearance of neurotropic manifestations at a later date will be kept in mind. The prognosis for vision depends on the presence or absence of nystagmus and, of course, on the condition of the retina and choroid.

I look forward to further improvements in contact glass development, for herein lies the greatest possibility for help in the future.

If we agree that these cases are the result of infection of the mother by "German measles", what can we do to prevent a repetition of the tragedy in any future epidemic? Is the mass of modern research into the causation of senile cataract going to be helpful by the discovery of some remedy which could be given to the mother to inhibit the formation of opacity in the developing lens of the embryo?

In the present state of our knowledge the only sure treatment available is that of prophylaxis. We must recognize and teach the potential dangers of such an epidemic or, I think, any other exanthem, and do all in our power to prevent its spread and particularly to guard the young married woman from the risk of infection.

As to confirmation of the theory of causation put forward in this paper, I suggest that the following line of investigation may be helpful. In all prenatal clinics and maternity hospitals very careful histories should be taken and recorded of exposure of the mother to infection of any kind during the entire period of pregnancy.

ACKNOWLEDGEMENTS.

I wish to thank all those colleagues, too numerous to mention, for the reports they have furnished me of their cases and for their permission to include them in this review.

I am also indebted to Dr. J. Ringland Anderson for his help with the literature on the subject; to Dr. Margaret Harper for her report on the cardiac condition; to Dr. B. Van Someren, of the New South Wales Government Health Department, for placing the records of his department at my disposal, and particularly to the sisters in charge of several of the baby health centres for the excellent reports they so kindly furnished; to Dr. Douglas Reye for his reports on the autopsies; and to Professor Harold Dew for his timely and helpful criticism on the presentation of this paper.

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D. R. GAWLER (Perth) referred to a child with this disease. It was seen when four months old and was ill nourished and suffering from impetigo. It showed intolerance to atropine and mydriasis was poor. The cataracts were nuclear and bilateral. The irides were blue and atrophic around the pupil. The Wassermann test applied to blood and cerebro-spinal fluid produced no reaction. No inquiry was made regarding maternal German measles. D. R. Gawler needled one eye and found the cortex and nucleus resistant. The cortex flaked off the anterior surface. There was little reaction to the needling. There was no epidemic of German measles in the district during the early months of pregnancy, but the mother said that there was another child in the town similarly affected. D. R. Gawler had no particular theories, but there might have been an endocrine deficiency, possibly involving the parathyreoids.

ARCHIE S. ANDERSON (Melbourne) had seen a few cases of this type and in every instance the mother had had German measles during the second month of pregnancy. He congratulated N. McA. Gregg on his striking and original inquiry.

G. H. BARHAM BLACK (Adelaide) said that he had seen one case in which monocular cataract and nystagmus were present. The mother had German measles six weeks after the last menstrual period. No inquiry had been made into the child's heart condition. The epidemic of German measles had occurred about the same time as in other States. There had been a number of severe cases. A soldier had died of encephalitis at Renmark. In South Australia an investigation had been made of streptococcal infections of the throat, but no streptococci had been found. Volunteers had submitted to inoculations from "camp" throat infections, but the results were inconclusive.

A. W. O'OMBRAIN (Newcastle) had seen four patients, two of whom had heart disease. He asked why the infection was described as "so-called German measles". One mother had German measles three months before pregnancy.

A. L. TOSTEVIN (Adlaide) spoke of a case he had seen. The mother, aged twenty-eight years, had had good health during pregnancy except for German measles at three months. There was no evidence of any abnormality of the child's heart. The mother noticed, when the child was six weeks old, that it could not see. He needled the eyes at three months. One cataract absorbed quickly, but the other, which was difficult, did not absorb well and the eye converged. Nystagmus did not develop. He prescribed +10 dioptre spheres and the child could apparently see reasonably well. The pupil did not dilate sufficiently well to allow of fundus examination. The eyes looked small and the irides were atrophic. He considered that N. McA. Gregg's contribution was very important and offered his congratulations.

W. M. C. MACDONALD (Sydney) added his compliments and stated that he had performed needling in some cases. One patient so treated had obtained a good result, but yet had developed nystagmus. In some of the others needling was difficult and the results were indifferent. It would be interesting to watch further developments. In all his cases there were heart conditions, and this showed how widespread was the involvement. The patients were all weakly.

LEONARD J. C. MITCHELL (Melbourne) asked whether there was more in the new syndrome than a mysterious association with German measles. He considered it a

matter for continued research by internists in order to discover the unknown factor at work in this most remarkable series of cases. He congratulated Dr. Gregg, and said he thought that this series of cases would be epoch-making.

N. McA. GREGG, in reply, said he did not want to be dogmatic by claiming that it had been established the cataracts were due solely to the "German measles". However, the evidence afforded by the cases under review was so striking that he was convinced that there was a very close relationship between the two conditions, particularly because in the very large majority of cases the pregnancy had been normal except for the "German measles" infection. He considered that it was quite likely that similar cases may have been missed in previous years either from casual history-taking or from failure to ascribe any importance to an exanthem affecting the mother so early in her pregnancy. He quoted the case of one mother with an affected child who was informed by another mother that her boy, who was born with cataracts, had died suddenly from disease of the heart at the age of seven, and that during this pregnancy she had had German measles. For the past five months he had asked the mother of every healthy young baby he had contacted whether she had been affected by "German measles" during the pregnancy and in no single case had there been any infection.

In regard to the few cases in the series in which there was no history of "German measles", he considered it quite likely that the infection had been slight and overlooked. He quoted Professor Dew as saying that in every virus epidemic some cases were subclinical. In reply to A. W. D'Ombrain, he said he had used the term "so-called German measles" because he believed this epidemic was different from the usual mild epidemics of this infection. The severity of the symptoms, the variability in the character of the rash and the frequency of rheumatic sequelæ in the victims seemed to him to support this view. He felt it was virus *plus*. He congratulated A. L. Tostevin on prescribing glasses for his patient at such an early age. He regretted he had been unable to make a slit lamp examination in his cases, but considered he was not justified in subjecting the babies to an anæsthetic for the length of time necessary to make such examination. In answer to L. J. C. Mitchell he said that in the more recent cases he had operated on both eyes at once, as this involved only one anæsthetic.

He informed G. H. Barham Black that he had operated on one child with a monocular cataract. He mentioned that in those cases in which the weight of the baby at birth was known, the average weight was five pounds.