A LECTURE ON DISEASE IN EARLY INFANCY.

*Being an Introduction to a Course of Lectures on the
Diseases of Infancy and Childhood.*

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In pediatrics ease and certainty in diagnosis and satisfactory results from treatment bear a direct relationship to the age of the child. The older the child is the more confident does the physician feel that he will be able successfully to ascertain the nature and completely to combat the manifestations of the disease of which his little patient is the victim. Most medical men feel that in treating the maladies of youth and of advanced childhood their knowledge rests upon comparatively sure foundations, and that in consequence of this a successful termination may, in the greater number of cases, be reasonably looked for. On the other hand, few practitioners can approach with equanimity the bedside of a sick infant or young child, make with absolute certainty the diagnosis, forecast with accuracy the course, and lay down with a feeling of security the lines of treatment of the disease. The younger the infant the more doubtful will be the diagnosis, prognosis, and therapeutic success of the case. These facts mean that there are peculiarities in the diseases of the young and that these are specially evident in infancy and early childhood. They also mean that medical students are not made sufficiently aware of the importance of the study of the diseases of infants and young children, the subject is not brought prominently before their notice in the medical curriculum and in the examination hall, and they are, therefore, sent out into general practice with a great deal to learn with reference to pediatrics, and with, perhaps, some preconceived erroneous notions to unlearn. It is not, however, of the absence of clinical and theoretical teaching in diseases of children from the compulsory training in so many of our medical schools that I wish at present to speak, but rather of the state of our knowledge concerning disease in infancy—the pathology of early life.

The acquisition of skill in the treatment of the maladies of infants is essential to success in general practice. Few men could afford to strike from their visiting list all patients of say five years and under, it would be relinquishing a large portion of their everyday work; and even in the practice of specialists in the eye, ear, throat, etc., infants bulk largely and form an important element. A knowledge of the peculiarities of disease in infancy must be the possession of the practitioner who wishes to excel in his profession and give satisfaction to his patients.

Certain difficulties lie in the way of the acquirement of this special pediatric knowledge. Assuredly want of opportunity is not one of these. Disease in infants is, unfortunately, only too common an occurrence. Neither can it be said that difficulties in the clinical examination of infants form an insuperable or even a considerable bar to progress in the department of infantile medicine and surgery. It may be difficult thoroughly to examine a struggling, crying, and frightened child; but a young infant is particularly tolerant of clinical methods of research. Further, the whole body of a baby is so small that one can easily and quickly inspect and palpate all parts of it. It is true that the infant cannot answer questions and give us information regarding his subjective symptoms; but, although speech is absent, he often gives us valuable hints as to the nature of his malady by means of cries and gestures which are evident to the experienced and trained ear and eye. An old writer remarked "infants, it is said, have not language to express their wants, but when a sensible mother and an attentive philosopher hear and observe them then they are very easily understood; their signs are as expressive as ours." It may not be possible entirely

to endorse all these words, but the general idea is a true one, and the application of the principle will often simplify the diagnosis of an infant's ailment.

Whilst the difficulties met with in the attempt to elicit diagnostic signs and symptoms of disease in early life are not of a formidable nature, those which relate to the understanding and appreciating of the meaning of these diagnostic indications are very real. There is in fact a special symptomatology of infantile disease. In one sense the signs of disease are easily to be appreciated, for they are commonly uncomplicated and have not underlying them the symptoms and effects of former illnesses; but in another and a wider sense they are difficult to understand, for their significance differs from that which holds in adult life and even in later childhood. The temperature curve in disease in infancy is an indication which it is very easy to misunderstand. Its sudden rise from a comparatively trifling cause has a significance which is often over-estimated, and the height to which the mercury ascends does not always appear to carry with it in the infant the same degree of danger as it does in the adult. Expectoration and cough are symptoms which are often absent in infancy in the diseases of which they are marked and reliable indications in the adult. The frequent absence of a distinct rigor at the commencement of fevers in early life is another disturbing element in diagnosis, and its replacement by a convulsive seizure or an attack of vomiting is a curious and significant clinical detail. The grass-green colour of the stools which so often accompanies infantile diarrhoea is a sign the full meaning of which has not yet been gauged; it also is peculiar to early life, and it is not known at what age it ceases to be so. The jaundice of the newborn infant is a most puzzling sign; sometimes it indicates a transient and unimportant gastric or hepatic derangement; sometimes it would seem to be only the physiological expression of some blood change associated with the changes in the circulation at the time of birth; and sometimes it is the sign of grave anomalies or serious disease of the liver. Other examples might be cited, but these will serve to show that the symptoms occurring in infancy have often a meaning other than that which they suggest in adult ailments.

I do not think we are justified in explaining, or attempting to explain these peculiarities in symptomatology by saying that the manifestations of disease in infancy are erratic. The signs of disease, it is true, do not follow the same rules in the infant as they do in later life; they are erratic in that sense, but they are, I believe, governed by laws as stable and unchanging as those which rule disease in the adult. Dr. Angel Money, in his suggestive work on *The Treatment of Disease in Children* says, "It is the unexpected that happens in infantile physiology, pathology, and treatment." That is undoubtedly the case in the present state of our knowledge; but as we learn better the laws which govern physiological processes in early life, and are able better to understand how the disturbance of these laws leads to disease, so it will be possible to know what to expect when called upon to form a prognosis, and what to do when required to treat an infantile ailment.

It is, therefore, evident that the difficulties that are met with in the due appreciation of the meaning of symptoms in the diseases of infancy are in the main due to a real want of knowledge regarding the laws of infantile physiology. That functional processes in the infant differ in many respects from those in the adult is very evident; and, while in some cases it is known in what way they differ and to what degree, in others this information is not yet forthcoming or not yet certainly agreed upon. The physiology of the circulation and of respiration in infancy has been fairly well ascertained, although even with regard to these processes there are hiatuses in our information; but with regard to the digestive functions and those connected with blood formation, mental and nervous action, and renal secretion, much has still to be learnt. Closely associated with these physiological peculiarities are the better known anatomical differences which distinguish the infant from the youth or man. These, also, have their bearing upon the symptomatology of early life. The great flexibility of the infant's spine, the relatively small development of its lumbar portion, the small amount of grey matter in the cerebrum, the large size of the thymus gland, of the adrenals, and of the liver, and the incomplete ossifica-

tion of the cranium, are all anatomical factors which must markedly influence the evolution of disease in the young.

The exact manner in which infantile pathology is affected by these physiological and anatomical peculiarities of the immature organism is a difficult subject to investigate; but with regard to some of the characters of infantile pathology information of a reliable kind is forthcoming, and with regard to others there are ever-increasing indications of the truth.

FATALITY IN INFANTILE DISEASES.

One of the most striking characters of morbid processes in the infant is their well-known and much-deplored fatality. During the first quarter of last year the rate of infant mortality, or the proportion of deaths under 1 year of age to registered births, was equal to 146 per 1,000 annually for the whole of England and Wales. In London it was 137 per 1,000; but it varied much in the different parts of the metropolis, and in some exceeded 200 per 1,000. In the large provincial towns also the rate of infant mortality was high (159 per 1,000); but whilst in some towns it reached and passed 200 per 1,000, in others it did not much exceed 100 per 1,000. Now, when it is remembered that the annual total death-rate is about 23 per 1,000, it becomes very evident that infants of 1 year of age and under suffer to a most disproportionate extent, and if the Registrar-General's returns are more closely scanned, it will be seen that during the first year also the liability to death increases in inverse proportion to age. Infants are more likely to die in the first month of life than in the second, and on the first day than on the second. Further, in order to gain a correct idea of mortality on the first day of life it would be necessary to take into account the number of infants that are stillborn and incapable of resuscitation. But this it is impossible to do, for the registration of stillbirths is not required by law in this country. This extraordinary state of affairs is not only almost peculiar to this nation; it is also a grievous blot upon our vaunted civilisation, and leads to most anomalous proceedings.

An apt illustration of the effects of the absence of the registration of stillbirths was given in a leading article which appeared in the *BRITISH MEDICAL JOURNAL* a few weeks ago. Two hypothetical, but no doubt extremely common, cases are put side by side. "Mrs. A. is delivered prematurely of a six months' child, which, but for an untoward circumstance, would not have been born till full time. It is born living, and survives its birth some minutes, breathing and crying feebly, then dying as the result of premature birth. Its birth and death are registered by the registrar of the sub-district with as much solemnity as if it had lived to be a centenarian, and the same burial order is given for the frail little body as for the body of a man 6 feet in height and weighing 15 stone. Mrs. B., on the other hand, is delivered of a fully-matured infant, which for various reasons, chiefly because of its full development and size, and, in spite of skilled medical attendance, is stillborn. No notice whatever is taken of it by the registrar; its body is taken for burial with a medical certificate of stillbirth, and it is duly buried as the body of a still-born infant."

It is evident that until stillbirths are registered it is impossible to estimate accurately the death-rate on the first day of life; but it is certain that the recorded figures are much below the reality, for every medical man knows in how many of his midwifery cases the infant is born in a state of asphyxia from which it never recovers.

POTENTIAL MORBIDITY OF THE FÆTUS.

Further, it will be necessary to add to the recorded deaths which occur on the first day of life not only the cases of stillbirth, but also those in which the infant is born dead on account of some intrauterine condition or disease, if it is desired fully to appreciate the immense destruction of life which takes place in early infancy. No doubt a part of the mortality which occurs among infants is due directly to the culpable negligence of parents and to their ignorance of the laws of hygiene. Errors in the feeding of infants serve to account for many deaths, and a disregard for the rules of healthy clothing and housing is responsible for many more; but at the same time it must, I think, be admitted that there is another circumstance which causes the great fatality of infantile disease, and this circumstance is to be found in the

character of the maladies themselves. What I mean is best illustrated by the congenital or fœtal diseases and abnormalities which become evident at birth and which are so often fatal. These diseases have existed in fœtal life; at what period they began it is not easy often to discover, but they were certainly present before birth, and yet the life of the fœtus has continued and development has gone on.

With the occurrence of birth, however, the infant finds itself in conditions in which it is not possible for its malformed or diseased organs to continue to conserve life. What was possible *in utero* becomes impossible in the extrauterine state. What was compatible with life and development so long as the infant lay in the uterus becomes the cause of death when organic severance from the maternal economy has taken place. At birth great changes occur, not only in the environment, but also in the intimate structure of the infant. Structures which have been active during fœtal life—the umbilical vessels for example—are no longer needed, and begin to atrophy. On the other hand, organs which have been quiescent and functionless in intrauterine life—such as the lungs, and probably also the kidneys—become important factors in the maintenance of life and health. Should any of these organs which at birth are called upon to play a part in the physiological processes of the body be imperfect, malformed, or diseased, or still more if they be absent, then a departure from the normal standard of health is at once set up, and death may, and often does, ensue. The morbidity which was potential in the fœtus has become real in the infant. It is for this reason, I believe, so many deaths occur in the first week of life and so many infants are stillborn. Some examples of this potential morbidity may be given in order to illustrate this contention. A few months ago there came into my hands a fœtus with complete absence of the brain and cranial vault (anencephalus), and with extrusion of the abdominal viscera and of the heart (exomphalos and ectopia cordis), conditions which were quite incompatible with an extrauterine existence; yet, up to the time of birth this fœtus had lived, had been nourished, and had developed, and even after birth its heart, displaced as it was, continued to beat for several minutes. The extraordinary combination of grave anomalies had failed to arrest life during intrauterine existence, but with the change in environment it became the cause of an almost immediate cessation of vitality. In another case I received from a medical friend a full-time fœtus with an imperforate condition of anus and penis and with other faults of development. Now, although the heart continued to beat for some time respiration could not be set up, and even if it had extrauterine life could only have been prolonged by surgically removing conditions which had not in the least interfered with intrauterine vitality. Then, again, I have recently dissected two fœtuses, each affected with general dropsy; in both there were signs of life at birth, but in a few minutes death supervened. The dissection revealed fluid in the pericardial, pleural, and peritoneal cavities, and an anæmic state of the viscera with slight splenic enlargement. The general dropsy was, therefore, compatible with an intrauterine, but not with an extrauterine, existence. I have found no record of a fœtus with general dropsy which lived more than a few hours after birth. Another condition which does not seem to interfere with life and development *in utero*, but which proves fatal a few days or weeks after birth, is an imperforate condition or complete absence of the common bile duct. The pathology of this condition presents many strange problems, but into these we cannot enter here, and it is cited simply as an example of the potential morbidity of some forms of fœtal disease. It is not, of course, necessary that the intrauterine morbid state always prove fatal at or soon after birth; it may continue in the same or in an exaggerated form, and so weaken the infant and render it more liable to die from other causes. Many infants, no doubt, die from hygienic errors after a few weeks' existence; but it is reasonable to believe that, in some cases of death soon after birth, the hygiene may have been perfect, and yet, from some obscure intrauterine malady or deformity, extrauterine life, under even the best environmental conditions, becomes impossible.

There is another point of view from which this subject may be regarded. Some intrauterine conditions can scarcely be regarded as pathological, and may yet become pathological in the act of birth. A fœtus a little above the average size can

only in a very limited sense be considered as pathological; it is, indeed, "well developed," and yet this very stage of great development may lead to its stillbirth or death. The large head cannot pass through the maternal passages without suffering such a degree of compression as leads to intracranial hæmorrhage, with all its results—asphyxia neonatorum in some cases, cerebral palsy in others. Again, the shoulders may be so broad as to cause delay in the labour after the birth of the head, and thus stillbirth may for this reason also be the consequence. Further examples of this variety of potential morbidity might be given, but enough has been said to show that, in many instances, conditions of the fœtus which were harmless *quâ* the fœtus become dangerous, if not fatal, *quâ* the newborn or young infant. There are other reasons for the great mortality which takes place at, and immediately after, birth; but the one above mentioned is of great importance, and must not be overlooked.

It must not, however, be forgotten that there is another side of the question. Some conditions which may be the cause of great danger to the fœtus *in utero* cease to be so the moment the child emerges from the maternal passages. Not long ago I saw an infant which had been born into the world puny and weak. The cause was looked for, and was found in the presence of a partially diseased placenta. After birth the infant with care lived and thrived. The threatening and dangerous intra-uterine condition was removed by the act of ligaturing the umbilical cord, and so separating the infant from the placenta. The defective supply of nourishment and the inefficient respiration were replaced by the normal extrauterine digestive and pulmonary functions, and the change was beneficial.

I have dissected a full-time infant which had evidently died a few days before birth from a tight knot on the umbilical cord, for mercury could be made to pass through the arteries but not through the vein. Now, had the tightening of this knot not occurred, the fœtus would in all probability have been born alive, for it was otherwise healthy. The real morbidity of the fœtus, then, may be checked or abolished by the change from an intrauterine to an extrauterine existence. This may not always, or indeed often, occur, but that it does happen sometimes is, I think, not doubtful.

This whole subject is capable of great expansion; a result which can only be accomplished by patient research and the systematic examination of stillborn and deadborn fœtuses; and the making of *post-mortem* examinations of cases of stillbirth would be greatly stimulated by their compulsory registration. What Morgagni said long ago is still to a large extent true. He remarked that "a wide and almost unbeaten track lies open for the investigation of the diseases of newborn infants;" and a very recent and striking instance of the truth of his statement is to be found in the appearance of such papers as that of Dr. Herbert R. Spencer on "Visceral Hæmorrhages in Stillborn Children." In this contribution to infantile pathology, the prediction made more than fifty years ago by Dr. Stokes has been amply fulfilled. He said: "I believe that anyone who has the opportunity of dissecting a great many stillborn children, or of those who die immediately after birth, would, by examining the state of the different cavities, and publishing the results of his examinations, earn for himself very great reputation."

THE African Steamship Company have received an intimation that during the recent voyage of their steamer *Angola* from Liverpool to the West Coast of Africa, Dr. Jackson—the surgeon of the ship, who was 28 years of age and a graduate of Dublin University, and was a son of Sir Robert Jackson, of Dublin—was drowned in the Bay of Biscay. It is stated that he met his death while endeavouring to alleviate the sufferings of an injured fireman. The weather was terrible, and everybody aboard the steamer had been cautioned against the danger of going aft. A fireman sustained an injury and was carried to the saloon, where the surgeon attended him. Requiring medicine for the sufferer, Dr. Jackson, in spite of warning of the risk he ran, attempted to reach his own quarters aft to procure it. He was never seen again, and was undoubtedly washed overboard and drowned.

¹ *Lond. Obst. Soc. Trans.*, xxxiii, p. 203, 1891.

REPORTS TO THE SCIENTIFIC GRANTS COMMITTEE REPORT ON EXPERIMENTS UPON "ABSORPTION WITHOUT OSMOSIS."

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As a result of a previous series of experiments,¹ in which the course of the osmotic transfer of fluid across the skin of the frog was studied, it was concluded that a satisfactory explanation of the observed facts could only be given upon the assumption that there is present in the living skin of the frog a vital absorptive force dependent upon protoplasmic activity and comparable to the vital secretory force of glands, and that by virtue of this vital action the skin is actually able to cause a stream of fluid to pass from its outer towards its inner surface. This conclusion was based upon the following facts: first, the magnitude of an ordinary osmotic stream maintained through perfectly fresh frogs' skin by means of fluids whose injury to tissue life is minimal, is capable of variation in the direction of increase or decrease, by such experimental conditions as are known to exalt or depress the activity of living matter; secondly, given a physical diffusion current in the direction from without inwards through the living frogs' skin, the presence of a stimulant to protoplasm augments the stream, while a depressant diminishes it; while on the other hand, should the diffusion current have been set up in the reverse direction, that is from within outwards, the stimulant causes diminution and the depressant augmentation of the amount of fluid transferred from the inner to the outer side of the skin in a given period of time. These phenomena failed to manifest themselves when dead skin was used for experiment instead of that which had been but recently removed, and which was therefore still in a living condition.

In the series of experiments just referred to, the variations that could be induced in an artificially-produced stream of fluid through the frog's skin by alteration of the physiological conditions were observed and recorded. Obviously the evidence of the existence of vital absorptive force would be far stronger could one put *osmotic* transfer of fluid on one side, and actually observe the passage of fluid across the living skin *by virtue of its own unaided activity*.

It is the object of the present communication to detail briefly a method by which this may be effected.

Apparatus.—The form of apparatus finally employed was a modification of one originally devised by Matteucci and Cima² for some osmosis experiments. Its general appearance is reproduced in Fig. 1.

The apparatus consists of two exactly similar parts, which can be adapted to one another and securely fixed by means of small brass clamps. Each half consists of a small glass cylinder (A) of 30 c.c. capacity, provided with an ebonite flange at its open end for purpose of adaptation to its fellow. Near the closed end a fine glass observation tube (B) is fused in, having a length of some 8 centimetres, and of such calibre that 1 millimetre has a capacity of 1.64 cubic millimetres. In a plane at right angles to that in which the observation tube lies, a neck is set for the introduction of fluid; this neck is stoppered by the thermometer (C). The ebonite flanges are accurately planed, so that when the two halves of the apparatus are clamped up the joint is watertight. The whole apparatus is fixed to a solid stand by means of a brass trip gripping one of the cylinders. To test the apparatus, the open ends of the cylinders are closed by a layer of *baudruche* which has soaked for twenty-four hours in normal saline solution. The two parts are then clamped together, filled with normal saline, and the thermometer stoppers inserted after all air bells have been cleared out. The instrument is then set with the observation tubes horizontal, and the utmost care taken in the final levelling. Finally, ivory scales, graduated in half millimetres, are affixed to the observation tubes, and the position of the meniscus in each tube noted. If the apparatus is truly level, and the *baudruche* well soaked so as to avoid imbibition error, the level of the fluid in the observation tubes is found to remain unchanged for an indefinite period. A temperature error, of course, exists, but after repeated trial I have found that a rise of 4° C. only produces an alteration of 1 millimetre in the level of the meniscus. The area of the opening in the ebonite flange, cemented round the open end of each glass cylinder is about 452 sq. mm.

¹ *Journal of Physiology*, vol. xi, p. 212.

² *Ann. de Chimie et de Physique*, t. xiii, 1845.