LECTURES ON THE PHYSIOLOGY AND PATHOLOGY OF MENSTRUATION.

Delivered at St. Mary's Hospital Medical School.

By ALFRED WILTSHIRE, M.D., F.R.C.P., Lond.,

Joint Lecturer on Obstetric Medicine; Physician-Accoucheur for Out-Patients;
Physician for the Diseases of Women to the West London Hospital;
formerly Medical Inspector to Her Majesty's Privy Council, etc.

GENTLEMEN,—We now approach the consideration of one of the most remarkable functions of the human economy, namely, menstruation, variously called the “menses,” “catamenia,” “periods,” “courses,” “changes,” “terms,” “shows,” “flowers,” and so on, a great diversity of names for this function being prevalent among the laity. Reference is made to it in the Sacred Book, the Bible; and laws, divinely inspired, are therein laid down for the observance of God's peculiar people, the Jews; laws which, after the lapse of thousands of years, are still piously observed by that remarkable people. The late Dr. Laycock, in his interesting work *On the Nervous Diseases of Women*, says of it: “There is no one function which has excited greater attention than the menstrual; law-givers, theologians, philosophers of every age, and the whole mass of mankind have taken an immediate, because necessary, interest in the matter; and the consequence has been, that much stress has ever been laid upon its importance in the female economy.”

Menstruation is a function, as its name implies, of periodical occurrence, and is characterised by a discharge of blood from the female generative organs; taking place typically, in women who are neither pregnant nor suckling, every month between puberty and the change of life. But, while in the majority of women the flow recurs at intervals of lunar months, there are considerable variations of the period within the limits of health. Thus many are “regular” every three weeks; others every five weeks; some every fortnight; while, in a few six weeks, and two, three, or more months may intervene between each menstruation, such periods representing the normal type of their catamenia. This implies a law of periodicity, and it may be said that the reproductive function in animals affects hebdomadal periodicity.

It has been customary to regard the function as specially pertaining to, or affecting only, the reproductive organs, but this is too restricted a view to take of it. It has much more widely reaching influences, the whole economy sharing in the cyclical perturbation. In the words of Dr. Farre, “Menstruation has evidently a much deeper signification than is declared simply by the flux, which is probably not the most important part of the function, although it constitutes the external sign or evidence of it;” and it will be my endeavour to show that the systemic phenomena associated with menstruation have important bearings upon practice. Besides, the function is not peculiar to the human female; for not only do the nearest allies of the human species display it, but a large number of creatures lower in the scale than apes, also possess it, or its analogue; as mares, asses, cows, sows, bitches, cats, etc. We shall see that its evolution is orderly, and corresponds broadly with the development of the generative organs of animals, attaining its highest level in those whose organic evolution is completest. It may be stated that in mammals—with possible and yet undiscovered exceptions—in proportion as we ascend the scale of being do we find the cestro-menstrual flux increasingly manifested; its sanguineous character becoming more and more pronounced, as the highest limits of organic development are attained. It appears to keep pace mainly with the evolution of the sexual organs, and to be chiefly correlated therewith.

You will gather, from my remarks upon the comparative physiology of menstruation,¹ that the evolution of the function can be traced from obscure and lowly beginnings upwards, indications of its inception being recognisable in inferior creatures; and the fostering influence of domestication and civilisation will become apparent as we trace its upward progress.

In most writings upon the subject, you will find the statement that the menstrual flow recurs every month, that it is accompanied by congestion of the generative organs, maturation of Graafian fol-

licles, and, according to some, by a special growth in, and shedding of, the lining membrane of the body of the uterus. This is, in most respects, in agreement with facts, but it falls short of complete truth. It is to the influence exerted by the menstrual process upon the economy at large that I desire especially to direct your attention. The systemic disturbance is distinct and marked; it is evinced in every element of the organism. The vascular system is notably implicated; so are the nervous, renal, hepatic, and glandular systems; while the cutaneous phenomena exhibit interesting analogies.

The most prominent feature of menstruation is a flow of blood from the genitals, the amount varying widely within the limits of health; the average normal quantity varies from two to eight ounces. It appears to be habitually less in those who follow laborious occupations than in those whose lives are luxurious, though doubtless there are many exceptions to this rule.

Many circumstances influencing the general health may affect the amount of discharge, such as the quality and quantity of food, the nature of the occupation, and the healthiness of habitations—in a word, the environments.

The duration of the flow also is variable, lasting in some only an hour or so, in others upwards of a week; the average lying between two and five days. The menstrual fluid consists of blood, with which is mixed epithelium and mucus of the generative passages. The peculiarity of the blood is, that ordinarily it is uncoagulated, and its fluidity has been attributed to the action of the vaginal mucus; some (Retzius and Donné) alleging that it is due to the acidity of that secretion, while according to others (Mandl), the mere presence of mucus or pus suffices to prevent coagulation. Microscopically, blood-corpuscles and epithelial débris are recognised. It has a faint odour, which has been likened to that of the marigold. When obtained pure from the uterus, its reaction is alkaline.

The body of the uterus is the chief source of the discharge, though the Fallopian tubes are believed to yield some.² Accordingly, much attention has been paid to the condition of the organ during menstruation, and especially to its mucous lining. Ordinarily, its mucous membrane (the uterus being regarded as a mucosa muscularis) is increased in thickness at the periods to upwards of a quarter of an inch, becoming then rugose. Kölliker has stated that numerous round and fusiform cells are developed during menstruation; and Engelmann, in conjunction with Kundrat, made researches showing that a change in the mucous membrane preceded the discharge, this being preparatory to the reception of the ovule. Subsequently, there would appear to be fatty degeneration of the different elements composing the mucous membrane, including the superficial blood-vessels. This may have an important bearing upon the mode of exudation of blood. Long since, Tyler Smith remarked the dehiscence of the uterine lining in certain specimens; while Dr. Williams, I believe, regards a prolonged growth and somewhat complete shedding of the mucous membrane as requisite for the exercise of the menstrual function. De Sinéty, on the other hand, asserts that normally there is no such desquamation, and Courty also considers that the formation of a new mucous membrane each month is not demonstrated.

Observers differ as to the exact nature of the changes which occur in the mucous lining. Dr. Flint considers there is an exfoliation of epithelium, but not of mucous membrane. Some maintain that the whole mucous membrane of the body of the uterus is shed every month; others (e.g., de Sinéty and Courty) contend that nothing of the kind occurs. Dr. Arthur Farre regards the uterine capillaries as having open mouths or stomata which dilate every month, continuous bleeding being prevented by the tonic contraction of the thick muscular wall of the uterus obstructing their calibre during the interval. Coste held that the blood exudes through the capillaries without laceration of their coats: that the process is one of diapedesis, in fact; and the recent observations of Vulpian, Cohnheim, and others compel the admission of the possibility of such an occurrence. The blood-changes presently to be described may influence the process, and deserve consideration in this connection.

My own inquiries support the conclusion that some breaking down of tissue usually occurs at the surface whence menstrual blood escapes, whatever that may be—normally the uterus; abnormally, other portions of the endectoderm—this change partaking of the character of fatty metamorphosis of the epithelial structures. The process may in truth be regarded as partaking of the nature of a moult.

It should be mentioned also that, according to some observers

¹ See BRITISH MEDICAL JOURNAL, March 3rd, 10th, and 17th, 1883.

² In the cow, the blood exudes from the cotyledons.

(Depaul and Guéniot), the process is most active on the side of the uterus corresponding to the ovary furnishing the ovule.

Jannier and Chantreuil also say that the changes in the mucous membrane of the uterus are most marked on the side corresponding to the ovary containing the follicle in process of evolution.

In discussing the changes in the uterine mucous membrane, it should be borne in mind that the periodical afflux of blood to the organ exaggerates the apparent thickening of that structure; and that, in the absence of vascular turgescence, its real thickness would be found less than is generally supposed. It is not denied that there is some augmented cell-production, but it is suggested that part of the bulk of the swollen mucous membrane is due to a vascular turgescence which is transitory. Menstruation is accompanied by intermitting uterine contractions; as a necessary corollary, there are corresponding dilatations, and the tidal flux and reflux promoted by this process is favourable to the escape of blood from capillaries, the nutrition of whose parietes is impaired by molecular change.

If the ovaries be excepted, the relations of the uterine annexes to menstruation have been somewhat neglected. At least one constituent element deserves consideration, that, namely, which may be regarded as a platysmoid muscle, or pelvic diaphragm; the widely spread and extensive layer of muscle encompassing the uterus and adjacent pelvic viscera, so well described by Rouget. This disseminated muscle springs into great activity during the cœstrum. The surmise may be permitted that, during menstruation, it may aid in producing the vascular repletion (in which venosity is so prominent) of the pelvic viscera.

Virohow has dwelt upon the importance of these structures. He says (*Cell. Path.*): "The thick muscular layers which traverse the ligaments are capable, under the irritating influence of the menstrual excitement, of provoking contractions analogous to those which are so clearly manifested in the external parts of the genito-urinary passages."

Those portions of Müller's ducts—the primitive generative canals—known as the Fallopian tubes, functionate as efferent ducts of the ovaries, and may therefore be regarded as subordinate to the latter organs; but, as integral parts of the genital tract, they are not without significance in relation to menstruation, although the high estimate of their importance in the process attributed to them by some writers yet requires substantiation.

The systemic phenomena manifested in the vascular apparatus justify the inference that menstrual blood escapes from the place of least resistance, that being normally the uterus.

Menstruation generally sets in with a feeling of *malaise*, or "poorliness," as it is significantly called, accompanied by a sense of weight and fulness in the back and genitals, a weary expression of countenance, darkness under the eyes, pallor or duskiness of the skin, tympanitic distension of the bowels, headache, lassitude, and so on. Such, or kindred symptoms in infinitely varied combinations, are manifested by the majority of women; but, though many habitually escape discomfort, individual peculiarities are common. More rarely, an abatement of customary discharges or eruptions is observed. In considering these phenomena, two facts become apparent: first, that they mostly affect cutaneous or mucous structures, ectoderm or endoderm; and, secondly, that they are associated with more or less marked vaso-motor changes.

Now, the general or systemic disturbance displayed at the advent of a period is called the menstrual molimen—a word derived from *molior*, to move or stir, an attempt or struggle; hence *molimen menstruale*, the menstrual diathesis or impulse.

The time of life at which the function appears is called puberty—an epoch characterised by remarkable changes in the bodily and mental constitution of women, who arrive at maturity at an earlier age than men. The attendant phenomena are, briefly, as follows. A great developmental impulse is perceptible in the human female; both mind and body exhibit striking changes. Vaso-motor disturbances are now perceptible. They are shown by occasional pallor, and by an increased tendency to blush—the prototypes of similar vaso-motor disturbances at the close of menstrual life. The bodily configuration is altered from that of the spare, thin, and angular girl, to the rounder fulness of early womanhood. The breasts become fuller; the hips widen; and a marked increase in plumpness is not unusual.

Mr. Darwin, referring to sexual selection, remarks: "It accords in a striking manner with this view of the modification and reinforcement of many of our mental faculties by sexual selection, that, firstly, they notoriously undergo a considerable change at puberty; and, secondly, that eunuchs remain throughout life inferior in these same qualities."

Dr. Maudsley well remarks (*Body and Mind*): "In the great mental revolution caused by the development of the sexual system at puberty, we have the most striking example of the intimate and essential sympathy between the brain as a mental organ and other organs of the body. The change of character at this period is not by any means limited to the appearance of the sexual feelings and their sympathetic ideas, but, when traced to its ultimate reach, will be found to extend to the highest feelings of mind, social, moral, and even religious."

Alienists are well aware that puberty is a trying time for the feeble-minded; and that insanity, previously concealed, may then become overt. Here, again, Dr. Maudsley well says: "The time of this mental revolution is, at best, a trying period for youth; and, where there is an inherited infirmity of nervous organisation, the natural disturbance of the mental balance may easily pass into actual destruction of it."

Now, in reference to these changes, I wish to direct your attention to facts of singular interest. The capability for reproduction does not arise until somewhat late in the life of the individual, when the body has attained nearly its full stature; and that aptitude is ordinarily evinced by the establishment of the menstrual function. Like conditions obtain in the lower animals—in some, perhaps, at a relatively earlier period of life; and the characteristic flux is increasingly sanguineous as the creatures rise in the scale of creation, being in the apes and higher monkeys almost as pronounced as in the human female. We find the generalisation to be in the main true, that, with increasing complexity of structure in the generative organs, there is increased complexity of function. But, in accordance with a law accepted by most biologists, functions govern structures. Thus, Mr. Herbert Spencer (*Biology*, vol. i, p. 167) says: "It follows that function is, from beginning to end, the determining cause of structure;" and Gegenbaur (*Elements of Comparative Anatomy*, p. 9) also says: "Physiological functions govern, in a certain sense, structure; and, so far, what is morphological is subordinated to what is physiological;" while Milne-Edwards, as quoted by Larcher in *Archives Générales de Médecine*, vol. i for 1859, p. 201, in an essay on "Hypertrophie du Cœur," says: "C'est la fonction qui détermine l'organe, et non l'organe qui détermine la fonction."

The antiquity of this law is coeval with Aristotle, who is reported, in Dr. W. Ogle's recent translation of his writings, *On the Parts of Animals*, p. 122, to have said: "Nature makes the organs for the function, and not the function for the organs."

Menstruation, then, though far from being the cause, is significant of the aptitude of the female for procreation, and is ordinarily accompanied by a diminished rate of growth. The relations of growth and reproduction are happily formulated in the words of Mr. Herbert Spencer (*Biology*, vol. ii, p. 436): "The antagonism between growth and sexual genesis, visible in these general contrasts, may also be traced in the history of each plant and animal. So familiar is the fact that sexual genesis does not occur in early life; and, in all organisms which expend much, begins only when the limit of size is nearly reached, that we do not sufficiently note its significance. It is a general physiological truth, however, that while the building up of the individual is going on rapidly, the reproductive organs remain imperfectly developed and inactive; and that the commencement of reproduction at once indicates a declining rate of growth, and becomes a cause of arresting growth." Gegenbaur (*El. Comp. Anat.*, page 52) says: "The phenomenon of the multiplication of the individual is primitively closely connected with nutrition. Not only is nutrition the cause of the growth, and consequent increase in size of the body, but it gives rise to a condition in which the organism converts the excess of nutrient material brought to it into the means for producing a new individual."

It does not follow that because conception is possible at puberty, it is therefore proper or desirable. Skilled observation teaches that reproduction in the immature is fraught with danger, both to mother and to offspring. Puberty and nubility are not to be regarded as uniformly synonymous, though that belief would seem to actuate the Hindoos and Eskimo in their early marriage customs. The reticence practised by most civilised races, in this respect, operates advantageously upon communities as upon individuals; for, as Mr. Darwin has shown, habitually premature breeding tends to suppress adult characteristics.

Regarding the age at which the function manifests itself, we find that, in temperate climates, puberty usually arrives between the fourteenth and fifteenth years; but there are wide variations in this. I have known menstruation to occur in three, if not four instances, at the early age of nine, and I have known it delayed to the twenty

third year. In reference to very early menstruation, we may distinguish between precocious and premature; whilst the so-called menstruation in newly born infants is to be referred to a different category, as also are the hæmorrhages which accompany acute specific and other diseases.

Cases in which menstruation has been established before the eighth year are regarded as precocious; those occurring at the eighth, ninth, and tenth year are said to be premature. But these terms are arbitrary; for, in some instances, the bodily development has been such as to permit healthy child-bearing even as early as the eighth year; several such cases being on record. Mr. Dodd records a case, in the *Lancet* (April 9th, 1881), of menstruation at the age of twelve months, and the delivery of a fine child at the age of nine years.

M. Bouchut relates a case of menstruation at twenty-two months of age, recurring every four weeks, and equal in amount to that of adults. Sir A. Cooper records a similar case. Carus and Kussmaul mention cases of early menstruation and pregnancy at the eighth year. Dr. Copland recorded a case, seen by himself, where the catamenia began at the sixth year, and he mentions cases even earlier. Prochownik (*Arch. für Gynäk.*) has lately recorded the case of a girl who died of acute bronchitis at the age of three years, who, from the age of one year, menstruated every month. At the *post mortem* examination, the uterus and ovaries were healthy, and the latter showed normal corpora lutea.

Menstruation is said to occur early among the Hindoos and African negroes, and generally at an earlier period in hot than in cold climates. Pouchet quotes Velpeau as stating that, in Lapland and Greenland, women menstruate only every three months; and Gardier says that, in Polar countries, it occurs only twice or thrice a-year. Schroeder states that it only sets in at the eighteenth year in the Swedish Laplanders; and Dr. Barnes quotes Dr. McDiarmid, surgeon to Sir John Ross's Arctic Expedition, as remarking that, amongst the Eskimo, it is often delayed until the twenty-third year, and then only appears scantily during the summer.

Dr. Barnes remarks: "I also know women, of feeble sexual development, who menstruate in India and not in England." Cazeaux makes a similar statement, and I myself have met with such instances.

But we find that racial peculiarity affects this function; for it has been observed that English girls born and residing in India menstruate, on an average, at about the same age as their sisters born and living in England; and in Austria-Hungary, where German and Hungarian people dwell near together in certain parts, the Magyar or Hungarian girls menstruate about two years earlier than the Germans. The effect of warmth is well shown by Dr. Emmet, who states that "more than half the women who have been under my observation menstruated for the first time during the season of four months between the beginning of April and the end of July. The explanation offered is that the organs of generation are in a more active state at this period of the year than at any other time"—an observation that is abundantly confirmed.

The average age of the commencement of menstruation of many hundreds of cases observed by myself is fourteen years and nine months. This seems to be about the usual English average. The menses cease at the "change of life," or menopause, which arrives, on an average, about the forty-fifth year. I have known it occur as early as the twenty-ninth year, and to be delayed as late as the fifty-fifth year, but such cases are rare. Just as puberty marks an epoch when life is in the ascendant, so is the climacteric the harbinger of vital declension. The "change of life" coincides in point of time, and is closely associated with, profound nutritional (degenerative) alterations in all the tissues, particularly in that most important integrating system, the vascular. Not only do the sexual glands and their appendages wither and fall into the disuse of age, their functions therewith becoming abrogated or annihilated, but all the peculiar influences, reflex and other, derived from them cease to operate actively upon the organism.

The "change of life," or menopause, is a physiological process; and, under normal circumstances, should transpire without undue constitutional commotion. But, whether from certain of the artificial conditions of civilised existence, or from the disproportionate demands upon the nervous system, the function sometimes fails to subside so peaceably. This epoch may prove one of sore trial, and is justly dreaded by some women. Dr. Maudsley says (*Body and Mind*): "The natural cessation of menstruation at the change of life is accompanied by a revolution in the economy, which is often trying to the mental stability of those who have a predisposition to insanity. The age of pleasing is past, but not always the desire,

which, indeed, sometimes grows then more exacting; there are all sorts of anomalous sensations of bodily distress, attesting the disturbance of circulation and of nerve-functions; and it is now that an insane jealousy and a propensity to stimulants are apt to appear, especially where there have been no children."

The relation of the ovaries to menstruation has been the subject of much discussion; the most discrepant views being advanced by the partisans of opposing camps; and still further difference has arisen as to the exact relation of ovulation, or the ripening of Graafian follicles, to menstruation. Because, in a few instances, women have menstruated after the removal of both ovaries, it has, on the one hand, been held that these organs cannot be essential to the function, while, on the other, it is alleged that their removal is commonly attended by its entire abrogation. Premising large qualifications, there is truth in both statements. Those who allege that menstruation may continue with its wonted regularity after the removal of the ovaries, do so on the evidence afforded by ovariectomies or oöphorectomies, wherein both ovaries have been removed without affecting the flow. Undoubtedly, such cases are on record; but I would beg your special attention to this important fact: that, while they are rare, they are, without exception, in mature or adult women, that is to say, in persons in whom the function has long been established, and whose bodies have been, and presumably therefore remain, subject to its periodical impress. The ovaries are now often excised to arrest hæmorrhage from uterine fibromata, and for other maladies, with, it is alleged, abundant success. No cases are known in which the complete ablation of the ovaries in early life has been followed by menstruation; it is abundantly proved that the removal of the sexual glands in early life is attended by the absolute abrogation of the sexual characteristics of the sexes. The whole truth rests absolutely with neither side, though it predominates enormously in favour of those who hold that the ovaries exert an important influence over menstruation.

And with regard to the ovulation-theory: here, also, the conflicting views admit considerable reconciliation. The researches of Pouchet, Bischoff, Raciborski, and others, have demonstrated the intimate relations that ordinarily exist between ovulation and oömenstruation. Although this relation is in the normal state harmoniously synchronous, yet it has been shown that ovulation may occur without its accompaniment, menstruation. It is held, by those who affirm that menstruation is directly excited by the maturation of Graafian follicles, that it only occurs in association with the ripening of Graafian vesicles, just as happens at the time of oöstruation in the females of the lower animals; and they alleged that menstruation is the exact analogue or counterpart in the human female of oöstruation in the lower animals—a statement which is to a large extent, if not entirely, accurate.

In the human female, there can be no question that the menstrual function is largely associated with the maturation of Graafian follicles, and that women, like the lower creatures, are more apt for conception about the period of menstruation; but, as sexual aptitude is not confined in women solely to the period of heat, and intercourse may be indulged in at any time, it is obvious that a disturbing element is introduced, and that, under artificial conditions, ova may be matured through sexual stimulation, or follicles ruptured under sexual excitement, which, but for such intervention, would have remained quiescent or dormant until the next normal oöstruation. Darwin says: "Corporeal, periodical, and mental habits become changed under domestication, and the changes are often inherited."

The higher organisation of woman, and the conditions of her life, render possible the more frequent proportional maturation of ova than in the lower animals in a wild state; and thus follicles may ripen out of their proper time and season, not only in consequence of her higher evolution, but under the stimulus of unwonted excitement.

Menstruation in women, in the ordinary normal undisturbed way, runs an even course with oöstruation in the lower females up to a certain point, but goes beyond it in that both the flow and ovulation may occur independently one of another. When the highest sexual organs (ovaries or testicles) are completely removed early in life, the characteristic sexual differences either do not appear, or are conspicuously modified; but, when their removal is deferred until these sexual differences have arisen, endured for some time, and have permanently left their mark upon the organism, the record of them, though perhaps not absolutely indelible, seems persistent in proportion as it has become established; and that may depend not alone upon its mere duration, but also upon the original intensity or inherent vigour of the sexual system.

Now, though observation shows that menstruation, largely analogous with oestration in the lower animals, usually coincides with the ripening of Graafian follicles, yet it would appear to be not necessarily and invariably dependent thereupon. Ovulation may occur without menstruation, for women may conceive who have never menstruated, while the not unfrequent conceptions of suckling women whose catamenia are absent are additional proofs of its independence. Ovulation is of higher genetic importance than menstruation. I have recently met with two instances of conception before the appearance of the menses. In one case, a well grown girl was married at the age of fourteen, became pregnant, and bore a fine child before she was fifteen, without ever having seen a menstrual flow. I am indebted to Sir Joseph Fayrer, for the information, given from personal observation, that "a refined people like the Hindoos never allow their daughters to menstruate if they can help it, the husband (marriage taking place at a very early age) being sent for." Robertson quotes from Elphinstone's *India*, that in Hindustan, by the code of Menu, a girl may be married at eight, or even earlier; and, if her father fail to give her a husband for three years after she is marriageable (*i.e.*, capable of becoming a parent), she is at liberty to choose one for herself. At p. 17, the following quotation is given from a Sanskrit scholar, the Baboo Gupta: "Atri and Kasyapa" (Hindoo sages) "state that, if an unmarried girl discharge the menstrual fluid at her father's house, the father incurs a guilt similar to that of destroying a foetus, and the daughter becomes *Brisalee*, or degraded in rank." Schroeder, in Von Ziemssen's *Cyclo-pædia* (vol. x, p. 320), states that, "Among the Hindoos, girls are obliged to marry before the establishment of the menses, because menstruation occurring in a girl who has not had the opportunity to conceive is regarded as infanticide." Power (quoted by Copland) considered gestation to be the natural condition of the mature female organs, and that a female menstruates because she does not conceive; an opinion that is shared by others. The foregoing facts, and those of superfetation, show that menstruation plays a subordinate part to ovulation; it being clear that that which is essential for the reproduction of the species is of higher importance than that which may be dispensed with—the flow of blood.

The whole subject of menstruation—its evolution, physiology, and pathology—will be fully elaborated in a work shortly to be published by myself; these lectures being necessarily much condensed.

ABSTRACT OF THE HARVEIAN LECTURES ON PROGNOSIS IN HEART-DISEASE.

Delivered before the Harveian Society of London, November 1883.

By W. H. BROADBENT, M.D., F.R.C.P.Lond.,
Physician to St. Mary's Hospital.

LECTURE II.—DISEASES OF INDIVIDUAL VALVES.

Aortic Stenosis.—We have been considering the general prognostic indications in valvular disease; we have now to take up the study of affections of individual valves. The first valvular change to be considered will be aortic stenosis; and we are at once struck by the contrast between Walshe's statement, "that narrowing of the aortic orifice stands first in the order of frequency among valvular diseases," and the statistics of the *post mortem* records of St. Mary's Hospital, as edited by Dr. Phillips, which give only 11 cases out of 151, with a few more in which stenosis of this orifice was associated with insufficiency of the valves. The explanation of this discrepancy is found in the fact that the systolic basic murmur, which is the diagnostic sign of aortic obstruction, is producible by other causes than obstruction. All the cases in which a systolic aortic murmur was audible have been classed as cases of aortic stenosis; while in only a small proportion of them was this condition present. I have long recognised that, while a systolic aortic is one of the commonest of the valvular murmurs, actual narrowing of the orifice is the most rare of the valvular changes.

A systolic aortic murmur may be due to several causes, which will now be enumerated.

1. **Anæmia** may be mentioned first. It is not well understood how it is that watery blood, deficient in corpuscles, gives rise to murmurs; but the fact is exemplified by the venous hum heard in the neck, by the pulmonary murmur, and also, though less commonly, by a systolic aortic murmur; this accompanies the first

sound, and does not substitute itself for it. With this **anæmic** aortic murmur may be grouped the hæmic murmur of very similar character, which sometimes accompanies or follows acute febrile disease of long duration, such as typhoid and rheumatic fever.

2. Mere roughening of the orifice or valves, or impaired flexibility of the latter, slight congenital malformation, fenestration of one or more of the cusps, a shred of fibre hanging from the edge of a valve, may give rise to a loud systolic murmur, without offering the least obstruction to the course of the blood.

3. Dilatation of the aorta just above the valves, the orifice and valves remaining unchanged, produces a murmur; the blood passing through an aortic opening of normal size into a larger cavity beyond is thrown into eddies, the vibrations of which produce a sound heard as a murmur. In none of the above mentioned conditions is there stenosis of the orifice or obstruction to the stream as it issues from the heart; the condition last named has dangers of its own, but they do not arise from aortic obstruction.

4. Acute narrowing of the mouth of the aorta is almost always due to changes in the valves, the cusps of which may be stiff and rigid with rounded and thickened margins; or adhesion may have taken place between the valves at the angle in which they meet; or, without being greatly thickened, the valves may be affected with atheroma, which destroys their flexibility, and puckers and contracts them, and may go on to calcification.

5. It is also possible, that, by dilatation of the ring at the root of the aorta, valves, not themselves greatly diseased, may be so put on the stretch that they cannot fall back, but remain as an obstacle to the stream of blood.

It is clear that the first point to be ascertained, when a systolic murmur is present, is, whether it indicates the existence of obstruction or not; in this we shall be greatly assisted by the history and existing condition of the patient. We should conclude that the murmur was hæmic when there was marked anæmia, or if the patient were convalescing from an acute illness, especially if murmurs were heard at other valves as well. A systolic aortic murmur appearing at middle age or in advanced life will seldom be due to actual narrowing of the orifice, but will be caused by roughness or rigidity of the valves, or by dilatation of the aorta above the valves with perhaps atheromatous irregularities in its walls. The significance of such a murmur at this period of life varies enormously; it may be produced by a harmless tag of fibre, or it may indicate aneurism of one of the sinuses of Valsalva, but it is rarely that as actual obstruction that injury results. The loudness or character of the murmur does not give us much help; hæmic aortic murmurs are usually soft and smooth, but so also may be murmurs due to extreme narrowing, especially when there is weakness of the ventricle, and languid propulsion of the blood; thus the gradual enfeeblement, and ultimate disappearance of a systolic aortic murmur, may be a most serious prognostic fact.

We turn now to the changes in the condition of the heart produced by aortic stenosis. The change, by which aortic obstruction will be overcome, will be hypertrophy of the left ventricle. The physical signs, therefore, of this hypertrophy, the position and character of the apex-beat and impulse, and the modifications of the sounds will enter into the diagnosis of actual narrowing of the aortic orifice. The character of the aortic second sound may aid in distinguishing hypertrophy compensatory of obstruction from the hypertrophy attending renal disease; it will usually be indistinct in the former, and always accentuated in the latter case. Almost more important than the hypertrophy of the left ventricle, will be the character of the pulse. The pulse-wave will be long and slow; the artery will be small and full between the beats of the pulse; a large sudden pulse is incompatible with aortic stenosis unaccompanied by regurgitation; and when it is a question whether or not an aortic systolic murmur is due to obstruction at the orifice, the pulse becomes the most certain criterion to which we can appeal; if there be an apparent contradiction between the indications of the heart, and those of the pulse, the latter must dominate. Even when there is co-existing aortic regurgitation, which tends to render the pulse large, sudden, and collapsing, the development of these characters is interfered with by stenosis. Nearly all authors concur in making aortic stenosis the least dangerous of the valvular affections, and, on *a priori* considerations, such would seem to be probable, but this conclusion will scarcely seem quite secure, if the cases of systolic aortic murmur, without actual narrowing of the orifice, are eliminated; the relative danger of real stenosis cannot, without further experience and inquiry, be estimated with confidence; but, it is certainly greater than has been supposed.

As a rule, aortic stenosis proves fatal by the slow operation of