PROVINCIAL MEDICAL AND SURGICAL JOURNAL.

Medical
Journal
1851
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1851

ON

DISINTEGRATION OF THE BLOOD.

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Read at the Anniversary Meeting at Hull, August 6th and 7th, 1850.

For some time past I have been engaged in observing, with considerable attention, the physical characteristics of the blood, in all those cases in my practice which afforded a fit opportunity for the examination. For this purpose, first, the specific gravity was ascertained; second, the relative quantity of serum and crassamentum was gauged, by means of a *hæmatometer*, (constructed on the plan of an *alkalimeter*.) This is a tube 6-8ths of an inch in diameter, marked at the height at which 1000 grains of distilled water would stand; it is then graduated by a scale of 100 degrees. Third, the quality of the serum was known by filling a smaller tube, to the line of 100 grains of distilled water. On taking the specific gravity we may judge of its density and the quantity of albumen it contains. No doubt better contrivances for the same end might be suggested; but though these instruments are simple, they are sufficient to give important indications of the qualities of the blood, and wherein there is a departure from a normal condition. To mention some select instances:—The blood of a man aged 61, of full habit of body, complaining of pain in the head, showed 91 per cent. of cruor. Let us contrast this with the blood in a case of chlorosis, in a girl of 17 years of age, who also was suffering from headache, in which the cruor was only 43 per cent. Blood taken in pleurisy, from a woman aged 39, contained 83 per cent. of cruor, 3 per cent. of fibrin in the form of inflammation and buff, and the remainder 14 per cent. of serous fluid. Without entering into details of the per centage of the physical elements of the blood under various diseases, and at the different periods of the disease, the experiments before us intimate that pathological hæmatology has just claims to our notice. Thus, from an examination of the blood in this manner, and seeing a deficiency in the normal gauge of the crassamentum, we may confidently assume there are deficient constitutional powers in the subject from which it was drawn. Moreover, these observations are of use to furnish us, at least, with general ideas of the morbid

condition of the blood, with much more accuracy than is usually attempted. The number of inspections of blood in a defective state have led to the arrangement of a group of diseases which may be strictly referred to a disturbed state of the circulation, producing either a transposition or total rejection of some of the vital elements. The object of this paper is to submit to the Association illustrations, in several affections, under which this evidently occurs.

I am about to consider diseases attended by disruption of the composition of the blood, and the dispersion of some of its vital elements. Now, whether that portion which is separated remain in the system or is totally excluded, there are good reasons for supposing the origin of the disruption to be from a loss of vital affinity in the organisms. On the present occasion it is my intention to speak only of leading principles in a branch of hæmatology specially relating to privations of the blood. I have adopted the term *disintegration* as most expressive of a dissociation of a triple compound of serum, fibrin, and hæmatosin. During sound health these organic elements are retained in the vascular system. The chemical products, or some contingent or new forms of organic matter only, are excluded by means of the secretions. In fact, to have any of the organisms of the blood present themselves, ex-circulatory, is opposed to the laws of the integrity of the circulating fluid, and would at once induce suspicions of a disorganization in its composition. We might bring under review a large class of diseases which seem to originate in disturbances of the organic elements, but will confine our notice to those affections in which the vital forces expel some of these constituents. One of the most remarkable instances of this is the expulsion of serum in *morbus Brightii*. Here the blood becomes deprived of its serum; on the one hand, a part escapes into the cavities and the tissues of the body, while another part is removed by the agency of the kidneys; on the other hand, there are diseases in which the gastro-enteritic apparatus is employed in the performance of a similar task, viz., to deserumize the blood; as in diarrhoea and cholera, wherein a double process is effected—first, a portion of the blood is deserumized, and secondly, it is discharged from the constitution. In other instances the serum, after its exclusion from the vessels, is detained in close cavities in the pleura, the tunica vaginalis, or in cysts. In such situations it is liable to remain with great inconvenience to the functions of im-

portant viscera. When deposited in the areolar tissue of the limbs, I need not say that their mechanism is exceedingly impeded. This is a general view of that species of disintegration which is known by a loss of serum. Although the objection might be raised that these fluids are mere secretions or exhalations, this is altogether a verbal distinction, inasmuch as the blood is minus the quantity of albumen contained in the fluids just named. To confine myself to a limited exemplification of deserumization. It may be artificially induced by the application of a blister to the skin.

The poison of the cantharides inflicts an injury, which ends in an effusion of serum under the epidermis, the blood having been deprived of as much serum as is visible in the vesication. Superficial burns and scalds subject the locality to rapid withdrawal of serum. Certain topical injuries cause topical disintegration of the blood, and an effusion of serum. Obstructions in the veins invariably produce a disengagement of serum. Thus the pressure of the gravid uterus, or of pelvic tumours on the iliac veins, frequently occasions effusion in the lower extremities. In phlegmasia dolens, by an inflammation of the saphena and its branches, or of the femoral vein, the current of the blood being interrupted, exudations into the cellular tissue certainly follow. The fluids in oedema, hydrocephalus, hydrothorax, or of hydrocele, prove their identity with the serum of the blood, by the albumen which, more or less abundantly, they contain. The pathology of limited dropsy or abstractions of serum appears scarcely explicable without admitting a dissociation of the liquor sanguinis and the red corpuscles. In cachexia the vessels may be feeble, *per se*, and incapable of transmitting the blood unimpaired, yet in leuco-phlegmatic temperaments it is more than probable that effusions originate in excess of serosity, and the escape of serum tends to afford relief by restoring, in some measure, the hematic standard. This is illustrated in an early scrofulous diathesis, where, in childhood, there is a disposition in the cerebral circulation to part with serum. The fluid which distends the ventricles of the brain contains albumen. Serous apoplexies likewise are of this character, notwithstanding the attack may arise from detention of blood in the sinuses, owing to disease of the heart. Taking into account the composition of the fluid in partial dropsy, and calculating the amount of albumen detected in it, we may conclude there must be partial disintegration of the blood. Nevertheless, structural and functional derangements of the vessels, as well as their contents, may be involved in local dropsy. Hence mechanical causes, or a ligature on the femoral artery, will occasion a temporary oedematous tumefaction, in consequence of an interruption to the current of the circulation. One of the results of an impediment in the portal system is a collection of serum in some part of the body. Instances of limited disintegration of the blood could easily be multiplied, but I will only mention its manifestation in oedema of the arm, when the axillary glands are implicated.

Limited collections of serum constitute the first series

of disintegrations of the blood. The second series shows an unlimited serous effusion; its remote cause is more obscure than the former, and it is by a combination of circumstances that its integrity is not maintained. Anasarca is one of the effects of a slow process of general disintegration of the blood, and general exudation of the liquor sanguinis and colourless corpuscles. Already an example of this form of deprivation of serosity has been referred to in albuminuria, where there is an excessive tendency of the serum to separate from the mass of the circulation. During the progress of this disease the liquor sanguinis is continually escaping by the kidneys, or is infiltrating into the areolar tissue, and perhaps finds its way into the pleura or peritoneum. Under these circumstances it has been ascertained that the relative proportion of corpuscles no longer continues. In one case the hæmatometer indicated 47 per cent. of serum, with a specific gravity of 1015, the healthy standard being 1030. To explain this circumstance I found, at the commencement of the complaint, the urine contained so large a quantity of serum, that when heated it was completely solid. The development of albuminuria is discovered by the unceasing circulation of the vital energies to exclude a quantity of serum from the vascular canals. Pathologists have apprehended a mutilated state of the blood; if so, it is desirable to define that state with as much precision of ideas as science will warrant. Dr. Johnson, of King's College, very properly considers that the existence of albumen in the urine is due to a disturbance in the circulation.* Dr. Ranking, with his usual clearness of judgment, after a comprehensive review of the various publications on Bright's disease, arrives at the following conclusion, that "there are diseases which attack the liver, spleen, and kidneys, which depend on an abnormal condition of the blood."† All the changes described so accurately by microscopists as taking place in the interstitial structure of the tubuli of the kidney are purely accidental, and altogether the result of "albuminous dyscrasy," induced by intemperate habits, unhealthy residence, or modes anti-hygienic. The tendency of the serum to become ex-circulatory can the more readily be accounted for by supposing that incidental circumstances have contributed to a loss of cohesion dependent on a loss of vital affinity in the sanguineous elements. While the blood preserves a perfectly healthy condition, its organic principles are inseparably retained within the boundaries of the circulatory system. There is no exception to this law. When, however, the renal organs, whose office is solely to secrete and convey the chemical material, is compelled to assume a new office, and convey a physical material of the blood, and when also we detect the latter in remote and foreign situations of the body, we may expect to find a corresponding deficiency in the circulation. As we find a low specific gravity of serum in albuminuria, so we ought to feel no difficulty in believing what some of the most en-

* *Medical Gazette*, November, 1845.

† *Transactions of the Provincial Medical and Surgical Association* 1847.

lightened pathologists have conjectured, that this affection is essentially a disease of the blood. It does not appear that the kidneys are anything more than mere agents in the removal of albumen, and in the performance of that duty sustain damage from retention of fibrin and fat globules; indeed, the quantity of the urine is seldom to be attributed to an error of these organs, but is rather to be imputed to a disturbed state of organic principles in other places. The granular degeneracy is entirely the result of protracted serous disease. Dr. Prout, in his Gulstonian lecture at the College of Physicians, exhibited the kidneys of a patient of Dr. Rowe's, who died of albuminuria, which were perfectly free from disease.* They transmitted serum without injury to their capacity or structure. Albuminuria consequently arises from a lesion of the blood, capable of demonstration. There are a variety of causes, particularly in large cities, which are calculated to impair the sound state of the blood. Dr. Bright instituted a series of experiments by taking the patients promiscuously as they lay in the wards of the hospital. The whole number amounted to 130, out of which he found no less than eighteen to have coagulable urine.† I am in the daily habit of testing the urine, but I confess I do not find albumen of so frequent occurrence. In rural districts, among an agricultural population, the condition of the blood is less deteriorated. Dr. Owen Rees and others have detected albumen in the urine of persons dying from complaints quite unconnected with lesions of the kidneys. He judiciously observes, that, "it is not right to lay much stress on albumen in the urine as indicative of nephritic disease."‡ The term albuminaria would be equally applicable to every species of disorder in which there is an adventitious collection of serous fluid; it might be applied to all the diseases in the order *Aquosæ* of Cullen. Every species of dropsy, as it regards the proximate cause, belongs to this series of disintegration—namely, deserumized blood. Sometimes there may be a drain of serum through the renal organs, at other times the serum is detained in certain parts of the system; be this as it may, the discovery of serum ex-circulatory would always lead to the inference of abstraction from the blood. In cases of Bright's disease we actually detect a deficiency in almost every analysis. On the contrary, an excess of serum, as in anæmia, may probably act in the same way in causing exosmose into the tissues in consequence of a dissolution of a portion of the triple organization of the blood.

The third series of disintegration consists in a deprivation of fibrin as well as serum. The most striking illustration occurs in malignant cholera. It is unnecessary to describe all the attendant phenomena, but to consider the hæmatology of this disease. After the reception of the choleraic poison, the abstraction of both serum and fibrin takes place frequently with such sudden and extraordinary violence, that during an

attack from six to twenty-four pounds of sero-fibrous fluid is expelled by the action of the stomach and bowels, in the course of a few hours. Mr. Grainger, who devoted much time and attention to investigations of this disease on the continent and in this country, in his lecture at St Thomas's Hospital last year, describes cholera as an affection of the blood. "That the best results which have been attained by the German pathologists, particularly those of Berlin, is that the first impression is aerial, acting on the blood, and thus the blood became poisoned." Dr. Wells has expressed in a short sentence his opinion of the nature of cholera—"A loss of vitality of the blood." Both of these gentlemen approach the true theory. One would imagine it impossible to overlook the destruction of a large portion of the colourless corpuscles. The alvine discharges, consisting chiefly of serum and coagulated fibrin. During health these substances are held in solution, but the vital force being withdrawn the albumen coagulates, the fibrin is precipitated, and we behold these substances in curdled flocculi, floating in the dejections. There is no one who has examined the blood in algide cholera who has not remarked its altered appearance. The dark colour and thick consistence have led some to compare it to tar, others to currant jelly. Dr. Parkes believes the fibrin loses its power of combination, and is poured into the intestines in flocculi, known as the solid ingredient in the so-called rice-water evacuations. Much as we may regret that the remote source of this scourge of the nations is still a hidden mystery, the immediate is patent to our inspection. We perceive the analogy there is between the action of the choleraic poison on the system, and the operation of an over-dose of tartarized antimony or arsenious acid. Indeed there is so great a resemblance of symptoms attendant on poisoning with arsenic, that it has often been mistaken for an attack of cholera. A large portion of blood has been disintegrated; this is followed by uncommon efforts to expel the affected organisms, and the spasmodic action seldom ceases until the whole of the affected corpuscles escape from the circulation, unless in fatal cases, where the organs concerned in the disengagement of the poison at length are disabled and unequal to the task. If the transparent corpuscles are very partially invaded, by timely aid of medicine and *vis vitæ* of the constitution, a reaction may be established which may neutralize the choleraic virus. To use the words of an eminent Professor:—"There are instances of the operation of the vital actions accomplishing the expulsion of noxious matter, and of that part of the animal fluid which have been corrupted by it.* This appears to be the course and determination of cholera, at least under a mild form. The dead corpuscles are excluded from the mass of the circulation. The assimilative process makes up the deficiency and restores the healthy tone of the blood.

It is not intended at this time to present tables of analysis; it will answer the purpose of the argument,

* 1831.

† Guy's Hospital Reports.

‡ Dr. O. Rees on Diseases of the Kidneys, p. 23.

* Dr. C. B. Williams' Principles of Medicine, p. 467.

in support of the theory advanced, to state that the blood of a healthy person contains of solid residue, on an average, 210 parts per 1000; but when an attack of Asiatic cholera has abstracted the transparent corpuscles, fibrin, and liquor sanguinis, the solid residuum amounts to 360 parts per 1000. In hæmatological inquiries there will be great irregularities in the results. The relative proportions of the organic principles are not so much dependent on age or sex as on habits of body and modes of life.

A fourth series of disintegrations of the blood is apparent in the separation and deposit of its fibrin. There is a frightful epidemic, well known in the West India islands, in which the fibrin becomes ex-circulatory, and eventually undergoes a slow condensation, and, as in all fibrinous deposits, it is then rendered insoluble. Such is elephantiasis. The parts most frequently affected are the lower extremities, but immense collections may be situated in the loose cellular tissue of the scrotum, or accumulated in the subcutaneous tissue of other parts. There is a class of tumours also with which we are more familiar, not only occupying the exterior of the body but invading the interior likewise; the morbid anatomy of which shews them to consist principally of condensed fibrin. The several stages of production are extravasation of serum, the aqueous portion of which evaporates by perspiration and exhalation from the lungs, leaving the insoluble fibrin under various forms. It has been demonstrated as intersecting scirrhus formations, and in such monstrous scrotal and preputial enlargements as such cases as *Hoc-loo's*, which are largely made up of fibrin, thrown out of the circulatory mass. The accretions distinguished as scirrhus, affecting the pylorus, the rectum, and the mamma, are of the same character. All these diseases are mainly composed of fibrinous exudations, in combination with, or existing as, a web containing other substances, as fat globules, cancer cells, and albuminous fluid. When fibrin is pure it often forms pseudo-membranes; as, for instance, in the adhesions of the pulmonary with the costal pleura, after a bad attack of pleuro-pneumonia. Inflammation induces a separation of fibrin; hence during inflammatory action fibrin is frequently poured into the canals lined with mucous membranes, as in croup, and in this specimen, where we have casts of the primary bronchiæ, produced by a transit of fibrin in acute bronchitis. The whole of this series are attributable to sanguineous derivations in consequence of an impaired vitalism of the blood, allowing of the exit of the liquor sanguinis by exosmose, or it may be ejected, under certain circumstances, by the energies of the animal powers. Fibrin while circulating in the system is always in solution, but when removed by disease it becomes solid.

The fifth series of cases of disintegration of the blood comprehends those affections in which effusions of red corpuscles or pure hæmatin is one of the most conspicuous features, as in scorbutus, purpura, and the petechiæ and vibices of typhus. The predisposing causes and primary sources of scorbutus have been traced to insufficiency of some needful article of diet,

especially if the privation is attended by mental anxiety and alarm. Of the proximate cause there is no question. We know the blood is dehæmatized when hæmatin has visibly escaped from the circulation; when there is a deprivation of 60 or 80 per 1000 of coloured corpuscles. The deficiency of fibrin, also, in most cases, has been noticed; hence Magendie called this disorder "Defibrination of the blood;" and truly the blood from the gums does not coagulate, for the crassamentum is loose and weak—"a semi-fluid of the consistence of syrup."

As, however, a similar defective condition of the blood is present in the advanced stages of fever, and in the phlegmasiæ, scurvy is better pathologically distinguished by the evident drainage of coloured corpuscles from the mucous membranes. We obtain the most correct diagnosis from the leading symptoms, viz., by the spontaneous appearance of hæmatosin. Looking at the multitude of facts which cases of scurvy present, can we reasonably doubt the breaking up of the fabric of the blood? The nature of the hæmorrhages which penetrate the mucous surfaces abundantly prove it.

Purpura hæmorrhagica bears a close analogy to scorbutus. The blood exhibits a loss of 10 to 20 per cent. of red corpuscles; but the extravasation of hæmatosin is sub-epidermic. The specific gravity of the blood is lowered from 20 to 40 per 1000. Each case may vary, yet the deficient quantity of hæmatosin is universal.

In further illustration of the doctrine of disintegration of the blood, instances might be cited of hæmorrhagic transpirations from the skin. Although such cases are of rare occurrence, there is on record one instance most impressive. There was one man who, under intense agony, sweat drops of blood. The physical possibility of sanguineous exudations of this kind, under extreme mental excitement, is confirmed by various writers. Blainville has given a case of bloody perspiration.* Another case is related in the *Philosophical Transactions*† of a child who bled from every part of the surface of the body. A similar hæmorrhage from the tongue, mouth, and scrotum is described by Mr. Amyot.‡ I might refer to Mr. Howard's "History of Foreign Prisons." "On visiting the prison at Avignon, (says this great philanthropist,) the gaoler told me that he had seen drops of blood mingled with the sweat on the breast of prisoners under torture."§ It would be subject for inquiry whether there are not numerous diseases in some of their stages attended with disintegration of the blood. Severe inflammation tends to isolate the colourless corpuscles, and in one patient terminates in effusion of serum, in another in deposition of fibrin. Dr. Alison infers "that inflammation and its effects are inexplicable by any alteration of the contractile powers of the living solids concerned in it, but must imply an alteration in the vital properties by which the constitution of the blood, in its relation to the surrounding textures, and its movement through

* *Course de Phisiol. Gen. and Comp.*, vol. iii., p. 59.

† Vol. x.

‡ *Medical Times*, June 22, 1850.

§ *Vide Foreign Prisons*, p. 52.

them is determined.”* Dr. Hughes Bennett has admirably demonstrated the *modus operandi* of the capillaries in exudations.† In a valuable work of Dr. W. Addison, the power colourless cells exert in controlling the nutritive changes is, I believe, correctly explained. While under abnormal action there is frequently an excess of cells, and they are diffused among parts adjacent;‡ I mean beyond their natural boundaries.

The present communication may be considered as an humble introduction to a more extended research into pathological hæmatology. I am happy to say Mr. Ancell is resuming the same subject in a series of able lectures in the course of publication;§ and it is impossible to overrate the importance of this branch of morbid anatomy. On reflection, we cease to wonder that diseases arise from modifications of the blood, when we take but a distant view of the numerous circumstances by which it may be altered. Atmospheric vicissitudes, aliment, drinks, respiration, and the condition of the nervous system, by which all the secretions are governed, exert a powerful influence on the blood, and produce numberless changes in the constitution. There would be a great advantage in having a more accurate mode of gauging the serum and crassamentum, since it would furnish some index of health and its deviations. The older authors were of opinion that the source of many disorders originated in the blood, but there is a great vagueness in their notions, for they were unacquainted with quantitative, physical, or chemical analysis. It has been reserved for modern physiologists to weigh and measure those realities which were before only matters of conjecture. Further inquiries are necessary to determine what value may be attached to the theory of disintegration of the blood. Of this I feel assured, we are advanced far enough to enable us to draw the conclusion that organic changes of the solids in general are not antecedent to an isolation of the elementary organisms, but depend on the dispersed and abnormal existence of the circulating corpuscular fluids. Hence the science of hæmatology deserves our highest consideration, and must be eventually estimated as the very foundation of all pathological investigation.

The examination of the blood is often desirable while the patient is under medical treatment; and in *post-mortem* inspections it should always be attentively noticed.

* Outline of Pathology, p. 120.

† *Monthly Journal of Science*, Jan., 1848.

‡ *Physiological Researches*.

§ Commencing in No. I., (new series,) of the *Medical Times*.

MM. Bequerel and Rodier have lately presented a memoir to the Academy of Medicine, “On Anæmia from Diminution of Albumen, and the Dropsy consequent thereon.”

CASE OF OVARIOTOMY.

By GEORGE NORMAN, Esq., F.R.C.S.,

SENIOR-SURGEON TO THE BATH UNITED HOSPITAL.

Read at the Quarterly Meeting of the Bath and Bristol Branch, Dec. 19, 1850.

ELIZABETH NORTH, aged 23, enjoyed good health until March of the present year, when she began to have a disturbed state of stomach, pains extending over the abdomen, irregular menstruation, and in May she became sensible of a swelling on the right side of her body. She became the patient of Dr. Davies at the United Hospital, who has obliged me by furnishing the following particulars:—

“Elizabeth North was admitted into the United Hospital under my care on the 7th of June, and was discharged on the 2nd of July. At the time of her admission she was suffering much from derangement of her general health, and the menstrual function had been out of order for some months. At this time the tumour on the right side of the abdomen did not appear to be larger than an orange; no doubt was entertained of its being ovarian. The treatment was addressed entirely towards the improvement of her general health, and she quitted the hospital much improved in that respect, the tumour remaining the same.”

She was admitted into the hospital again, under my care, on the 19th of September. The tumour then appeared to be nearly as large as the head of a child at birth; it was quite moveable in the abdomen and appeared to be attached below by the broad ligament of the uterus, for no doubt was entertained of its being a tumour of the right ovary. It was firm to the touch and gave no sense of fluctuation; her general health had much given way; she had pain extending over the abdomen, and at times severe cramps in the bowels; a fold of vagina protruded full two inches beyond the external pudendum, even when in the recumbent position, and she had endeavoured in vain to keep this up by a pessary before her admission. It was with great difficulty the os uteri could be felt; after a considerable examination it was found under the arch of the pubes. She was kept in bed, took iodide of potassium, and used iodine frictions to the abdomen, still the tumour increased in size and the pains in intensity.

The case was considered by my colleagues and myself, to be an ovarian tumour, and that if ovariectomy were ever advisable, this patient's case was one calling for it. The prolapsed state of the vagina, the weight of the tumour, and the continued pain, rendering it impossible for her to do anything for her support; the tumour was increasing and there seemed to be no hope of its growth being arrested. It was agreed that she should discontinue all remedies for a fortnight. At the end of that time her general health had not improved and the tumour appeared to be as large as the impregnated uterus at the fourth, or between that and the fifth month. I then explained to the patient the nature of the disease, told her that an operation had in some