OCHRONOSIS

THE PIGMENTATION OF CARTILAGES, SCLEROTICS, AND SKIN IN ALKAPTONURIA

BY

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SKIN IN ALKAPTONURIA.

HERETOFORE ochronosis has been a pathological curiosity; the two cases here reported in alkaptonuria show that it may have interesting clinical features.

In 1866 Virchow\(^1\) described a remarkable blackening of the cartilages in the body of a man, aged 67 years, who had died from aneurysm. The colour was coal black (as shown in his figures), not ochre-coloured or yellow; but it was not ordinary melanosis, and recognising the unique character of the condition Virchow called it ochronosis. Years passed before a second case was described by Boström,\(^2\) that of a woman, aged 44 years, who had died from strangulated umbilical hernia. The same ebony-black discolouration of the cartilages was present. Then in 1892 Hansemann\(^3\) described a third case, the patient being a male, aged 41 years, with general oedema and aneurysm of the left ventricle. He had had melanuria for 18 years. In a recently issued number of the *Deutsches Archiv für Klinische Medicin* Langstein and Meyer state that the examination of long-kept urine shows that this was not a case of alkaptonuria. There was no reduction of copper and no homogentisic acid could be found. Heile\(^4\)

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1 Virchow's Archiv, 1866, Band xxxvii., p. 212.
2 Virchow's Festschrift, Band ii., 1891, p. 177.
3 Berliner Klinische Wochenschrift, 1892, Band xxix., p. 660.
4 Virchow's Archiv, 1900, Band clx., p. 148.
recorded the fourth and fifth cases, one being that of a woman, aged 36 years, who had died from peritonitis after ruptured tubal pregnancy, and the other that of a woman, aged 52 years, with chronic leg ulcer and mitral valve disease. The sixth case was reported by Hecker and Wolf. The patient was a man, aged 73 years, with long-standing melanuria and chronic endocarditis. In the eyes on each side some three or four millimetres from the corneal border there were black spots on the sclerotics. The urine was sometimes normal in colour when passed and sometimes brownish. It became black on standing for a day or two. The darkening was present for 11 years but was not constant. Blood, bile-pigment, indican, pyrocatechin, and drug pigments were excluded. It is distinctly stated that the urine did not reduce copper. Hecker and Wolf came to the conclusion that the reactions were those of melanuria. Post mortem there was the ordinary ochronotic blackening of the cartilages, arteries, &c. I am indebted to Dr. A. Garrod for this abstract from the Festschrift of the Dresden Hospital and he states that it is pretty certain this was not a case of alkaptonuria. The seventh case is recorded by H. Albrecht, to whom is due the credit of suggesting the association of the condition with alkaptonuria. In a man, aged 47 years, who had died from pulmonary tuberculosis, the urine was dark-coloured and reduced the sulphate of copper, but the presence of alkaptonuria was not proved, for no homogentisic acid was obtained from it. After a week in the hospital he died and the necropsy showed a general ochronosis. A point of special interest was the grey-blue colour of the inner part of the ears, as if due to dilated veins.

I am able to report two cases of ochronosis in alkaptonuria in which the condition could be recognised clinically by the deep pigmentation of the cartilages of the ears and of the sclerotics, and in one by a remarkable ebony-black discolouration of the skin of the nose and cheeks.

5 Festschrift, Dresden Hospital, 1899, p. 325.
6 Zeitschrift für Heilkunde, 1902, Band xxiii., p. 366.
CASE 1.—A man, aged 57 years, consulted me on Jan. 16th, 1895, for diabetes and rapid action of the heart. He had been an active business man and a successful politician. I did not question the existence of diabetes, as during a prolonged residence in Europe he had been under the care of several eminent colleagues in Berlin, Paris, and London, one of whom had referred him to me. After repeated examinations Dr. Futcher determined that the copper-reducing substance was not glucose and the case formed the basis of his paper on alkaptonuria in the New York Medical Journal in 1898. I need not refer in any detail to the condition of the urine in this case other than to state that it is never black when passed but darkens after a few hours. At my first examination I was impressed by a remarkable appearance of the sclerotics which showed small V-shaped areas of deep pigmentation near the cornea. I thought it might be the result of old haemorrhages, but the patient said that the condition had gradually come on and that it had annoyed him at first but that he now thought nothing of it. There was also a slight pigmentation of the nose and on the cheeks which looked like very thickly set comedones. As he left the room my attention was directed to the deep blue colour of the inner surface of the ears. I have seen the patient at intervals during the past eight years and have taken an increased interest in the deepening pigmentation of his face, eyes, and ears. I searched the literature at intervals for an explanation but without avail and I consulted Dr. de Schweinitz and Dr. Harry Friedenwald with reference to the pigmentation of the sclerotics. It did not seem to conform with any of the reported cases of this rare condition. Lately the patient came under my care in the private ward of the Johns Hopkins Hospital for anaemia and a weak, irregular heart. The pigmentation has extended considerably in the past six years and is now as follows.

Sclerotics.—The exposed V-shaped portions are of a deep black colour, not in the entire extent, as there are areas of normal colour. The staining is in the sclerotic coat, not in
the conjunctiva, and it does not extend to the covered parts of the eyeballs. Of late years it has become much darker; there was a brownish tinge in places which has now almost disappeared. There is nothing special to be noticed about the other parts of the eyes. The tarsal cartilages are not affected.

Ears.—From behind and along the free border of the helix the skin looks normal but when looked at from inside there is a remarkable blue-black discoloration, exactly like that produced by dilated veins, as Albrecht remarked. It is deepest in the concha and extends along the antihelix but not to the helix. I did not recognise at first that the pigmentation was in the cartilage. In certain positions and when the light falls into the ears the colour at once attracts attention. It has extended and deepened in the past five years.

Face.—Over the nose and the cheeks, in very much the butterfly distribution of lupus erythematosus, the skin is of a coal-black colour. At his first visit I thought that it was an unusual distribution of very black comedones. The line over the nose is narrow but widens and passes to the cheeks and extends over the malar bones and along the zygomatic. There is no thickening of the skin, which can be picked up easily. The colour is remarkable, quite unlike anything seen in the skin in the ordinary pigmented changes, but at first glance rather suggesting powder marks. Where present it is uniform, not patchy. It is nowhere else on the skin but Dr. Futcher tells me that small black spots have begun to appear on the back of the hands. One of this patient’s sons has alkaptonuria.

Case 2.—The patient is a brother of the patient in Case 1, his age being 49 years. This was one of the first cases of alkaptonuria described in the United States of America. He had applied for life insurance and had been rejected repeatedly. Dr. Marshall, of the University of Pennsylvania, studied the urine carefully and called the new copper-reduc-
ing substance glycosuric acid. The man remained quite well after he had got over his fright about diabetes. When the first patient was in the hospital this brother visited him frequently, and what was my surprise to find that he too had pigmented sclerotics and ears. The patches in the eyes were small, two vertically placed bands about five millimetres from the corneo-sclerotic junction. They resembled in size and appearance those in his brother's eyes when I first saw him in 1895. The blue-black colour in the ears, not nearly so marked as in Case 1, was confined to the fossæ and could not be seen from behind. The skin was normal, but through it appeared this remarkable leaden colour as though there was a diffuse nævus. The patient had noticed the pigmentation for several years. He was morbidly sensitive about it and it was with the greatest difficulty that I could induce him to come to the clinical laboratory where Dr. Emerson determined the persistence of the alkaptonuria. This patient died in April, 1903, from pneumonia after an illness of a few days. There was no post-mortem examination.

These brothers presented a singularity in gait, walking with a slight bend or incline at the hips. At first I thought the elder brother had had spinal disease but the spine was straight and the motion of the hip-joints was perfect. He had had rheumatic pains in many joints and there were several Heberden's nodes.

Dr. Ogden of Milwaukee writes with reference to his alkaptonuria patient, whose condition was described in the Zeitschrift für Physiologische Chemie, 1895, that "the colour of the inside of each concha is a pearly, light-greyish lead-blue, much the colour of the inside of some of our common mussel shells." This is evidently staining of the cartilages similar to that which exists in the two patients here described and in Albrecht's case.

There is no question that these are cases of ochronosis in long-standing alkaptonuria and they support Albrecht's suggestion that the pigmentation of the cartilaginous tissues is associated with the remarkable disturbance of metabolism
which we have heretofore only recognised by the changes in the urine. The condition is thus brought within the range of the clinical physician. Fortunately it is not of much moment, so far as we know, and in the recorded cases there have been no symptoms directly due to the alkaptonuria. Dr. Garrod informs me that there are only two recorded post-mortem examinations in alkaptonuria cases. In Förbringer's case the patient, a male, aged 29 years, died from phthisis. There is no mention of the duration of the alkaptonuria. The necropsy was made by Thoma and the description is complete. Blackening with alkalies was looked for in the body fluids, but there is no mention of blackening of the cartilages. In von Moraczewski's case (a woman, aged 43 years) the alkaptonuria was supposed to be of late development. There is no mention of the cartilages in the protocol of the post-mortem examination. Some of the cases of ochronosis have not been in alkaptonuria and, as Dr. Garrod writes, it looks as if possibly even the very few cases described may belong to two distinct classes. Of the three cases in which black urine is mentioned two at any rate seem not to have been in alkaptonuria, and in Albrecht's patient Zdarek could not find in the fresh urine either homogentisic or uroleucic acid.

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7 Berliner Klinische Wochenschrift, 1875, Band xii.
THE "PTHISIOLOGIA" OF RICHARD MORTON, M.D.*

By WILLIAM OSLER, M.D.,
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August 22, 1662—Black Bartholomew's Day, as it has been called—brought sadness and sorrow to many English homes. The enforcement of the Act of Uniformity called for subscription to the Thirty-nine Articles, and enforced the use by all clergymen of the Book of Common Prayer. Among those ejected for refusal to subscribe—2,000 in number, it is said—was a young man, aged twenty-five, the Vicar of Kinver, in Staffordshire, Richard Morton by name. The son of a physician, born in 1637, he had been educated at Oxford, where he took the B.A. in 1656-57, became chaplain to his College and took the M.A. in 1659, and in the same year was appointed to the vicarage of Kinver. From the days of St. Luke there have been many instances of what has been called the angelical conjunction of physic and divinity. In the seventeenth century many men could sign after their names, as did Robert Lovell in his History of Animals and Minerals (1661), Φιλοθεολογικατρόνωμος. Following Linacre's example, clerical orders have been taken as a rule by the physician late in life, but Morton, ejected from his living, turned his attention to medicine at a comparatively early age. From Baxter's account, he evidently was a loss to the church. He speaks of him as "a man of great gravity, calmness, sound principles, of no faction, an excellent preacher, of an upright life."

It is not known where Morton studied medicine. On the nomination of the Prince of Orange he was created an M.D. of Oxford in 1670. He settled in London, became a Candidate of the Royal College of Physicians in 1675, and a Fellow in 1679. He prac-

*Read before the Johns Hopkins Hospital Historical Club, January, 1900.
tised in Grey Friar's Court, Newgate Street, and had an unusual measure of success. He became physician-in-ordinary to the King, and enjoyed the confidence both of the profession and of the public. He seems to have been an intimate friend of Sydenham and a strong supporter of his new way in physic. He died in 1698.

His most important work is the *Phthisiologia*, 1689, of which there were six or seven subsequent editions in the succeeding century. Two English translations appeared, one in 1694, and the other in 1720.

His *Pyretologia* appeared in 1692, and is chiefly of value today as giving one of the most systematic and thorough accounts of the malarial fevers of that date.

The *Phthisiologia* is one of the first systematic treatises on pulmonary consumption. The writers of that date had, however, not got beyond the classification of phthisis given by Celsus and which embraced the forms of disease with which wasting and atrophy were associated, *i.e.*, atrophia, cachexia and phthisis proper, or consumption.

Morton's title-page of his English edition gives very well his classification: *Phthisiologia: or a Treatise of Consumptions. Wherein the Difference, Nature, Causes, Signs, and Cure of all sorts of Consumptions are explained. Containing Three Books, I. Of Original Consumptions from the whole Habit of the Body; II. Of on Original Consumption of the Lungs. III. Of Symptomatical Consumptions, or such as are the Effects of some other Distempers. Illustrated by particular Cases, and Observations added to every Book. With a Compleat Table of the most Remarkable Things.* Of these, Book II alone concerns us at present. Book I deals with the wasting associated with discharges of all sorts, suppurations, diabetes, dropsies, sweats, etc. Two points may be mentioned in passing. Under what he terms nerv- ous consumption, I think we may recognize Gull's anorexia nervosa, particularly in the history of the two cases which he narrates. Under the section "De Tabe à Diabete," which he calls "Hydrops ad Matulam" (dropsy of the chamber-pot), he describes, for the first time, I believe, the family form in children and notes one case of recovery in childhood.

Morton was one of the first to give a clear account of tubercles in the lungs. Celsus had used the word tubercle and was stated to have introduced it into the language of medicine, but by it he really meant any small round tumor of whatever nature. Mor-
ton’s description of tubercle is as follows: “A crude Tubercle or Swelling is bred from the Obstruction of some Glandulous part of the Lungs; to wit, when a greater quantity of Serum, or Water is separated from the Blood, than is thrown out by the Duct of the Glandule: From whence is comes to pass, that as the Part affected being too much distended by the Humour that is imprisoned in it, is deprived of its natural Tone, and thereupon is no longer able to spew or throw out the Serum, or Water that flows into it, or is separated; so likewise the Humour, that is so shut up, not being any more renewed by an influx of fresh Humour, does by degrees grow dry and hard from the Natural heat of the Part: From whence arises a hardness, that resists a pressure, or a Tubercle (of which we are now speaking) which in progress of time, after the natural Tone of the Part is in this manner destroyed, is wont to be inflamed, and to turn to an Aposteme sooner or later, according to the Nature of the Lympha, or included Humour, and of the Blood, from which it is separated, which indeed is the whole immediate cause of a Consumption of the Lungs, and of the dry cough which attends it.”

A very interesting point is that he had a strong belief in the very great prevalence of tuberculosis of the lungs, and he says: “Yea, when I consider with my self, how often in one Year there is cause enough ministered for producing these Swellings, even to those that are wont to observe the strictest Rules of Living, I cannot sufficiently admire that any one, at least after he comes to the Flower of his Youth, can dye without a touch of a Consumption. And without doubt the breeding of these Swellings is so frequent and common, that a Consumption of the Lungs would necessarily be the common Plague of Mankind, if those Swellings did not vanish, or were not removed by Art as easily as they are bred at first: And indeed I have been used to think, not without Reason, that as the more Benign Tubercles are wont to go off of their own accord, and that quickly, so none of them lay the Foundation of this great Disease, of which I am now treating, but only those which are in some degree Malignant, and ill-natured, and that are wont to putrefie sooner or later from some peculiar quality in their Nature, from what part soever of the Body they have their Original.”

Among the procatartic or predisposing causes he mentions want of exercise, night studies and watchings, a hereditary disposition, an ill-formation of the breast, whether natural or accidental, and infection. The more immediate cause was the taking
of cold and the production of hard swellings, which he takes to be the crude tubercles mentioned by Galen, arising in the glandulous parts of the lungs.

The important point in the prevention of the disease is to be careful in the six non-naturals, in eating and drinking, in sleep, exercise, evacuations, passions of the mind, and the use of "open, fresh, kindly air and such as is free from the smoke of coals." He remarks in conclusion about the prophylaxis of consumption: "But alas! Physicians have very seldom an occasion to give their Advice about preventing this Distemper (when in the beginning perhaps it may be cured as well as other Diseases, although for the most part by neglect it proves fatal) the sick Persons seldom employing Æsculapius help before the Distemper has run on so far as to be a fatal case, and then they in vain expect Miracles from the Art of Physick, when it is more convenient for them to have the good Counsel of a Minister about the future Salvation of their Souls, and the Advice of a Lawyer about making their last Will."

The diagnostic and pathognomonic signs of the beginning of a pulmonary consumption are three: cough, fever and loss of weight. He gives a very full account of the cough of tuberculosis, and describes the form which has been known by his name, in which the patient coughs until he vomits. The fever of tuberculosis is of two kinds: the inflammatory, which has its beginning from an inflammation of the tubercles in the lungs, and which is similar to other forms of inflammatory fever, and is to be treated in the same way; and the putrid, intermittent fever of tuberculosis, which begins with a chilliness and coldness, proceeding with great heat, and at last ends in profuse and colliquative night sweats. This form accompanies a consumption to the patient's dying day, and is not to be cured with Peruvian bark or any other specific medicine. I do not know that any author previously had given such a good description of the two types of fever which we now recognize.

His description of the marasmus with the Hippocratic face is excellent. The account of the night-sweats is worth reading: "For the Sweats always come on, when the Putrid Fever is going off, to wit, after Midnight. For this Fever (whether it be a Tertian or Quotidian) comes like other Intermittent Fevers at a certain hour (which is about Noon, or a little after) with a manifest chillness, but then proceeding for some hours with a burning Heat, Drought, Restlessness, Vomiting, shortness of Breath, a continual,
fierce and violent Cough, want of Sleep, yes, sometimes also Light-headedness, and a very red color in the Cheeks, proceeding from the Oppression of the Lungs, and those parts that are seated under the Short Ribs: But at length, to wit, about Midnight, it ends in vast and colliquative Sweats. At which time the Patient sleeps quietly, breathes not so short as before, and plentifully coughs up concocted Phlegm without any difficulty or pains, having the Symptoms of the Fever all gone off altogether of their own accord. For at this time the stream of the colliquated Humour is turned from the Lungs, and carried to the Pores of the Skin. And by that means the Patient seems all the morning to be free from a Fever, his Heat is moderate, and his Pulse low, until at length another new fit seizes him, and breaks the Treacherous Peace. And from these remissions of their Fits it often happens that these kind of Consumptive People, even when they are lookt upon as deplorable by others, flatter themselves extramly with the hopes of their Recovery; so that the same Persons that at Night use used to think themselves irrecoverable, and tell those about them they should certainly dye, yet the next Morning they always pluck up their Courage, and in vain entertain the hopes of living long."

The description of the diarrheea and of the throat symptoms, with observations on the condition of the urine and pulse, are those of a skilful, well-trained observer.

Of the varieties of consumption of the lungs he describes an acute and a chronic. He mentions a number of cases, his father's (a very skilful physician) among them, who had cough and fever for many years. He was a strong believer in the cure of consumption in its early stages—"the consumption does admit of a cure as well as other distempers." He confesses that a confirmed consumptive is rarely cured, but "if it be but a small part of the lungs that is ulcerated and the matter be benign ... the life of the patient may be preserved many years by the careful management of himself." The hereditary consumption, and that got by infection, he says, and those occurring in the young are hardest to cure. "Every consumption, though it be cured, is apt to return, and he that has once been in a consumption, unless he governs himself very regularly, falls back into the same condition."

His section on treatment is far inferior to that on symptomatology. He advises bleeding at the outset, the use of the chalybeate waters, a milk diet, the plentiful use of shell-fish, and testaceous
medicines, that is, prepared coral, crab’s eyes, powder of crab’s claws, and cray-fish broth. There was a strong opinion prevalent that these hard remedies were very helpful to a cure of consumption. For the cough he used van Helmont’s liquid laudanum, but warned against the sudden death that sometimes followed too much opium in the third stage of the disease. The Peruvian bark was his mainstay in the fever, and opiates and milk wherein steel had been quenched several times, for the diarrhea.

One misses the strong statements found in Sydenham as to the value of fresh air in the treatment of the disease. Sydenham states, upon fresh air and horse-back riding, “I am sure that if any physician had a remedy for the curing of a phthisis of equal force with this of riding, he might easily get what wealth he pleased.”

In the third book of the treatise are considered the symptomatic consumptions of the lung, such as are the effects of some other distempers. In the section on scrofulous consumptions, by which he means tuberculous adenitis, it would appear that he appreciated the identity of the affection in the glands with that in the lungs. He says, “and what happens in the other glandulous parts happens also in the lungs themselves.” “Those who have the King’s evil, who are frequently subject to glandulous swellings in other parts, are likewise many times affected with such kind of tubercules even in the lungs themselves.” He states that “a scrofulous consumption,” by which remember he means a tuberculous adenitis, “is curable when the tubercles are crude.”

One of the most interesting sections is that upon a consumption caused by the spitting of blood (the phthisis ab haemoptoe) which he regards as one of the most fatal and incurable of the forms of consumption.

Another interesting form of consumption very fully described by Morton is that caused by stones “bred in the lungs,” which he describes as smooth and chalky and without the least tubercle, or sometimes sharp and angular, causing a tearing of the lungs, with pain and the spitting of blood. He gives three cases of the spitting of lung stones associated with consumption.

A very interesting section is one on the consumption caused by peripneumonia and pleurisy, which pass into apostemes of a great bigness, and which may rupture, either internally into the windpipe, in which case the patient may be suddenly strangled or choked, or externally. He advises, if the patient can bear it, paracentesis when fluctuation is present.
Morton fully appreciated the contagious nature of tuberculosis, as the following passages indicate. I have already mentioned that he placed contagion as one of the causes. In several of his histories he recognizes it. Under scorbutical consumption he gives the history of a Mr. Hunt, who had been from his youth to the seventieth year of his age in a consumptive state. His three sons after the thirtieth year, one after another, “by the right of inheritance” were seized with a consumption, which “carried them off before the emaciated old man died.” “The widow of one of them, as well from her grief for the death of her husband as from other causes, and from the taking of cold in often watching with him, and perhaps by infection too (because she lay with him to his dying day) took the disease, but gradually recovered by the use of the Islington waters.” Under the phthisis ab haemoptoe, he mentions a young man, having married a virgin that was a consumptive and who died within a year after marriage, who, a few months after her death, fell into a consumption “by contagion.”
ON THE SURGICAL IMPORTANCE OF THE VISCERAL CRISSES IN THE ERYTHEMA GROUP OF SKIN DISEASES.

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The possibility of mistaking these visceral crises for appendicitis or intussusception or obstruction of the bowel, and handing the patient over to the surgeon for operation, is by no means remote. In Case II. of my series\(^1\) one attack was unilateral, and of such severity that the physician who was called in, knowing nothing of the previous history of the case, diagnosed renal colic. In Case XX. the child was admitted to the surgical wards supposed to have appendicitis. Fortunately the skin rash was noticed, the pain subsided, and he was transferred to the medical wards. The association of the colic with the passage of blood *per rectum* may, of course, lead to the diagnosis of intussusception. In the January number of the *British Journal of Children’s Diseases*, vol. i., No. 1, Dr. G. A. Sutherland reports the case of a boy, aged five years, who, eight days before admission, had been seized with severe abdominal pain and vomiting. After continuing intermittently for four days the attack passed off, but recurred two days later in a more persistent manner. The day before admission the motions were blood-stained. The boy looked very ill; the abdomen was distended, and he had recurring attacks of severe colic. The temperature was normal. The next day the abdomen was more distended and palpation was impossible. It was decided that the symptoms indicated obstruction from intussusception. The abdomen was opened and the sigmoid flexure was found much distended; “on going over the small intestine a part of the bowel about five inches long was found, which was dark in color, evidently from extravasated blood, and with thickened walls.” There were no other hemorrhages visible. The boy reacted well from the operation, and for the next five days he had only occasional pains. He then for the first time had a skin eruption, with albumin in the urine, and the diagnosis was cleared up.

In a second case reported by Dr. Sutherland, a girl, aged seven years, was admitted to hospital with Henoch’s purpura. She had

\(^1\) The American Journal of the Medical Sciences, January, 1904.
a prolonged illness with the usual attacks of abdominal pain, vomiting of blood, melæna, albuminuria, and haematuria. She gradually recovered, and three months later was readmitted with a recurrence of all the symptoms. The pain was more severe, referred to the umbilicus, spasmodic and colicky in character. There were hemorrhages similar to the previous attack. She died in a general convulsive seizure. The temperature was 104° F. There was acute general peritonitis and intussusception of the cæcum and part of the ileum into the colon. The involved portions of the intestine were black and hemorrhagic and gangrenous. As Dr. Sutherland rightly surmises, the fatal attack was induced by hemorrhage into the wall of the colon, leading to paralysis of the affected part and to increased muscular contraction, with colic, in the adjoining part of the bowel. As a result of these strong muscular contractions the sound part of the intestine became invaginated into the paralyzed and hemorrhagic portion.

In the same journal there is reported by Mr. Harold Burrows a case in which laparotomy was performed. A boy, aged eleven years, was admitted to the Bolingbroke Hospital July 6th with a diagnosis of obstruction from intussusception. After feeling out-of sorts for ten days, on the morning of the sixth he was seized with violent pain in the abdomen and vomiting, and shortly afterward passed blood, the vomitus being dark brown, with a fecal odor. There was general tenderness of the abdomen; no distention; no lump. The abdominal muscles were held rigid. The patient was examined under an anaesthetic, and it was decided to operate. A few inches from the ileoceleal valve the ileum showed small petechial hemorrhages and some irregular patches of congestion. The peritoneum over these parts was sticky and had lost its gloss. On the following day the patient was free from pain, but it was then noticed that there was a skin eruption. From the history the boy had had on June 26th, eleven days before admission, some arthritis and a skin rash.

The following case, at present in my wards, is a further illustration of the surgical importance of this group of cases.

Lena F., aged seventeen years, admitted for the first time December 1, 1903. The patient was seen by Dr. McCrae in consultation with her attending physician. She was in bed, rolling about with the pain, and at times assumed very curious positions, getting in the knee-elbow position and crouching and bending, very rarely staying very long in any one place. The pain was evidently of great severity, paroxysmal in character. Examination of the abdomen was negative. There was no tenderness anywhere on pressure; no resistance. The knee-joints were slightly swollen and quite tender. There was no skin eruption; no fever. She had had large doses of morphine hypodermically, which only relieved the pain for a short time. The association of the arthritis made Dr. McCrae
suspicious of the form of abdominal colic associated with skin lesions and nephritis. She was removed to the hospital with some difficulty.

The history obtained was as follows:

She had been a healthy girl. The family history was excellent except that the mother was very neurotic. There was no rheumatism in the family. She had been very well as a child and had grown and thriven. Six months before admission she had her first attack of pain in the abdomen, which every week or two had recurred and had been very severe. The attack was usually associated with vomiting. It had no relation to food, never associated with jaundice; no chills. The bowels were obstinately constipated. The attacks recurred with great severity, and on August 3d an exploratory operation was made at the City Hospital—an incision in the upper part of the abdomen. The gall-bladder was found to be clear and there was no sign of gastric ulcer; no appendicitis. Three weeks after the operation the attacks recurred, and she has had a number of very severe paroxysms. On admission she was a healthy-looking, well-nourished girl. The abdomen was not distended; no special tension; palpation could be made readily in all regions and was negative. Examination of the thoracic organs was negative. The knee-joints were a little swollen and tender, not red. Examination of the gastric juice on two occasions showed nothing special. The stools were searched carefully without finding anything abnormal. For the first few days after admission she had attacks of pain lasting from one and a half to two minutes, colic-like in character, readily controlled with codeine. She vomited on December 1st. There was no special change in the leukocytes. The count on admission was normal; coagulation time three minutes. On December 5th she had slight bleeding from the nose. On the 6th there was a trace of albumin in the urine, which persisted, and toward the close of her stay in the hospital there were a few hyaline casts. There was no skin rash. The knee condition rapidly disappeared. She was discharged December 15th, very much improved.

She was readmitted January 28, 1904. She had been very much better, but she had had slight attacks. On January 25th the colic became very severe and she had much nausea. She had had recurring attacks of bleeding from the nose, and once, she said, bleeding from the gums. There had been no skin eruption. The knee-joints became swollen and painful shortly after admission. The leukocytes were 12,500. The urine on the 29th (catheterized specimen) was smoky, and contained albumin in small amount, a few red corpuscles, and numerous hyaline casts. She remained in the hospital for nine days; the pains lessened, and she improved in her general condition.

The practical lessons to be drawn from these three cases in which laparotomy was performed are: first, that in children with colic the
greatest care should be taken to get a full history, which may bring out the fact of previous attacks, either of skin lesions, of arthritis, or of intestinal crises; and secondly, to make the most careful inspection of the skin for angioneurotic œdema, purpura, or erythema. It is also to be borne in mind that recurring colic may be for many years the sole feature of this remarkable disease, as in Cases XVII. and XXVII. of my series, in which the obscurity of the attacks of colic was not cleared up until the final appearance of skin lesions. In the case here reported the intestinal crises, in combination with arthritis and the renal features, leave no doubt as to the diagnosis. In her next attack there may be purpura or angioneurotic œdema, or an acute nephritis may occur alone. The colic is the most constant of the visceral manifestations, occurring in twenty-five of the twenty-nine cases in my series. So far as I know, it is never dangerous. In no case recorded has death resulted, I believe, from intestinal causes. The examination in the cases of Dr. Sutherland and Mr. Barrows confirms the view that the colic is due to infiltration of the intestinal wall with blood and serum.
ANEURYSM OF THE ABDOMINAL AORTA

BY

WILLIAM OSLER, M.D., F.R.S.

REGIUS PROFESSOR OF MEDICINE AT THE UNIVERSITY OF OXFORD.

Reprinted from THE LANCET, October 14, 1905.
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ANEURYSM OF THE ABDOMINAL AORTA. 1

ANEURYSM of the abdominal aorta is very often diagnosed when not present, and when present the symptoms may be so obscure that the nature of the trouble is overlooked. I propose in this paper to speak of some aspects of our experience at the Johns Hopkins Hospital during the past 16 years, particularly with reference to the large abdominal tumour caused by the ruptured aneurysm. I have put in tabular form the cases, 16 in number, with the chief features. I have no intention of speaking of the history of the condition but I cannot refrain from two references. Vesalius was not only the first to recognise an aneurysm of the thoracic aorta during life but to him also we owe the first clinical description of aneurysm of the abdominal aorta. In the letter to Gasser acknowledging the receipt of the post-mortem report of a case of aneurysm of the thoracic aorta, which he had recognised two years before, he refers to an abdominal aneurysm in a woman who had had for many years a pulsating tumour below the stomach. 2 It is quite possible that this may have been only a throbbing aorta but it is evident that Vesalius had had his attention strongly directed to this disease, as he tells Gasser in the same letter that he had seen six cases of aneurysm since his consultation with him in Augsburg. 152 years later (1719) Valisneri (whose name is linked with the plant known to all young students of biology) made the diagnosis of aneurysm of the abdominal aorta in the case of a carman at Padua, aged about 30 years, who had had syphilis and over whose abdomen a wheel had passed. For eight months he was in bed with severe pains in the loins and back and after having been seen by several physicians Valisneri detected a pulsation and diagnosed aneurysm. The part afterwards swelled and the tumefaction extended and even raised the contiguous ribs. An unskilful surgeon opened the tumour; a copious effusion of blood followed and the man died in a quarter of an hour. Morgagni was present at the examination, when an aneurysm was found extending from the diaphragm to the pelvis, the organs were displaced to the right, and even the left kidney

1 A paper read before the Medico-Chirurgical Society of Montreal. 2 Roth's Vesalius.
was situated in the umbilical region. The sac contained a large quantity of lamellated concretions at the periphery and granulous blood in the centre. The ribs and the spine were eroded, the transverse processes and the bodies were nearly destroyed, whilst the thick intervertebral cartilages were all in their natural position, prominent and untouched by disease and beautifully whole. Here we have for the first time, I believe, a careful observation of the fact that the intervertebral discs resist the power of erosion—yielding, they do not feel the pressure. The case is of exceptional interest in connexion with some of those which I here report in which the diagnosis of tumour was made.

**Incidence.**—These 16 cases occurred among about 18,000 admissions to my wards. The ratio of abdominal to thoracic aneurysm was about 1 in 10. The incidence varies in different localities. In Vienna, in 19,300 necropsies there were only three cases among 222 cases of aneurysm (Schröter). Of 468 cases of aneurysm at St. Bartholomew’s Hospital, there were 23 of the abdominal aorta, 1 in 20 (Oswald Browne). J. H. Bryant’s recent paper gives the Guy’s Hospital figures for the years 1854–1900 inclusive as: 18,678 necropsies, 325 cases of aneurysm of the aorta, of which 54 were of the abdominal part of the vessel—16 per cent. Among the first 2200 necropsies at the Johns Hopkins Hospital there were 49 cases of aneurysm of the thoracic and 11 of the abdominal aorta.

**Etiology.**—Of the 16 cases, 14 were males and two were females. All statistics indicate the infrequency of the disease in women, a point to be borne in mind in diagnosis as the throbbing aorta is much more common in them. Nine of the patients were under 40 years of age. In three the disease had started before the thirtieth year. In two of Bryant’s series the disease began before the twentieth year and 63 per cent. of the patients were under 40 years of age. Only seven of the patients had been very heavy workers. A definite history of syphilis was obtained in nine; in four others it was doubtful. Ten of the patients were alcoholics. Into the relationship of aneurysm to syphilis I cannot enter here. I believe it to be the all-important cause in persons under 40 years of age, and the more carefully we inquire into the history the larger the percentage of luetic cases. In 12 the aneurysm was saccular, in three rupture had occurred with the formation of a diffuse aneurysm, and one case was of the dissecting variety.

**Symptoms.**—In two patients the condition was latent and was found post mortem. Pain of a persistent, often of an agonising, character was present in 13 of the cases. It is

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2 Morgagni: *Section on Diseases of Aorta and other Vessels (Case 17).*
3 Clinical Journal, 1903.
TABLE OF CASES OF ANEURYSM OF THE ABDOMINAL AORTA AT THE JOHNS HOPKINS HOSPITAL, BALTIMORE, U.S.A.

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>M</td>
<td>69</td>
<td>No.</td>
<td>No.</td>
<td>Yes.</td>
<td>Pain, nausea, and vomiting.</td>
<td>Tumour; thrill; no murmur.</td>
<td>Exploratory laparotomy.</td>
<td>Tumour had lasted 3 years; remarkable mobility.</td>
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<tr>
<td>5</td>
<td>M</td>
<td>27</td>
<td></td>
<td></td>
<td>No.</td>
<td>Pain.</td>
<td>Tumour; thrill; systolic and diastolic murmurs.</td>
<td>Wiring and electrolysis.</td>
<td>Death in 48 hours; rupture through the diaphragm.</td>
</tr>
<tr>
<td>6</td>
<td>M</td>
<td>36</td>
<td></td>
<td></td>
<td></td>
<td>Tumour; systolic murmur; pulsation behind.</td>
<td>Large tumour; systolic murmur.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>7</td>
<td>M</td>
<td>68</td>
<td>Yes.</td>
<td></td>
<td></td>
<td>No symptoms.</td>
<td>Tumour; systolic bruit.</td>
<td>Wiring and electrolysis.</td>
<td>Death on ninth day; rupture into peritoneum.</td>
</tr>
<tr>
<td>8</td>
<td>M</td>
<td>36</td>
<td></td>
<td>No.</td>
<td></td>
<td>Great pain.</td>
<td>Large tumour; systolic and diastolic bruits.</td>
<td>Wiring and electrolysis.</td>
<td>Discharged in 4 weeks. No change.</td>
</tr>
<tr>
<td>9</td>
<td>F</td>
<td>33</td>
<td>?</td>
<td>Yes.</td>
<td></td>
<td>Pain.</td>
<td>Large tumour; systolic and diastolic bruits.</td>
<td>—</td>
<td>Death on fourteenth day; rupture of sac.</td>
</tr>
<tr>
<td>10</td>
<td>M</td>
<td>53</td>
<td>Yes.</td>
<td>No.</td>
<td>No.</td>
<td>No pain.</td>
<td>Large tumour; systolic and diastolic bruits.</td>
<td>Wiring and electrolysis.</td>
<td>Pulsion much diminished; discharged in 4 weeks; no subsequent note.</td>
</tr>
<tr>
<td>11</td>
<td>M</td>
<td>38</td>
<td>Yes.</td>
<td></td>
<td></td>
<td>Pains.</td>
<td>Great improvement; lived 3½ years.</td>
<td>—</td>
<td>Dissecting aneurysm of entire abdominal aorta.</td>
</tr>
<tr>
<td>12</td>
<td>M</td>
<td>43</td>
<td></td>
<td></td>
<td></td>
<td>Pain.</td>
<td>Large tumour; thrill; systolic murmur.</td>
<td>—</td>
<td>Aneurysm (sacculated) of entire abdominal aorta; found post mortem.</td>
</tr>
<tr>
<td>13</td>
<td>M</td>
<td>30</td>
<td>Yes.</td>
<td>No.</td>
<td></td>
<td>Pain; vomiting.</td>
<td>Tumour; thrill; systolic murmur.</td>
<td>—</td>
<td>Rupture; diffuse aneurysm; death 6 months later.</td>
</tr>
<tr>
<td>14</td>
<td>M</td>
<td>31</td>
<td>Yes.</td>
<td>Yes.</td>
<td></td>
<td>No abdominal symptoms.</td>
<td>Death from pneumonia.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>15</td>
<td>M</td>
<td>54</td>
<td></td>
<td>No.</td>
<td></td>
<td>Latent.</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>16</td>
<td>M</td>
<td>49</td>
<td></td>
<td></td>
<td></td>
<td>Pain.</td>
<td>Large pulsating tumour; rupture.</td>
<td>Wiring and electrolysis.</td>
<td>—</td>
</tr>
</tbody>
</table>

Note: The table provides a detailed account of cases of aneurysm of the abdominal aorta, including chief symptoms, physical signs, operations performed, and remarks on the outcomes.
usually the first indication of the trouble and throughout
remains the feature, reaching an intensity not met with in
any other disease. Five of the patients were taking large
doses of morphine before admission. Associated with
pressure upon, or stretching of, the nerves it is of a constant,
dull, boring character, varied in some cases with paroxysms
of frightful severity. Erosion of the vertebrae is usually
associated with intense pain, but not always, as there may
be extensive destruction without much pain but as a rule
there is severe aching, boring pain which, when the nerve
roots are involved, may radiate in their course. And lastly,
the pain may be due to rupture of the sac and the passage of
the blood into the retroperitoneal and muscular tissue. It
may simulate the pain of gall-stones, of renal colic, or of
appendicitis and pressure on the nerves may cause pain in
the testicles and in the course of the anterior crural or
sciatic nerves. The recumbent posture may be impossible
during the paroxysms. Pressure usually gives slight relief.
Stokes, whose description of aneurysm of the abdominal
aorta remains unrivalled, recognised the remarkable
characters of the pain—the dull, boring, steady form and
the awful paroxysms. Beatty’s classical case, which he
quotes in full, first called the attention of physicians to these
special features of the disease. It is interesting to note that
Andral regarded Beatty’s case as a rare form of intestinal
neurosis.

Nausea and vomiting were early and severe symptoms in
two cases. Hæmatemesis did not occur in any cases of the
series. Constipation was a common feature. Intermittent
claudication occurred in one case. Altogether, apart from
pain and the features associated with rupture of the sac,
there were not many symptoms and the patients were usually
well nourished and healthy-looking. Hæmorrhage from the
bowels occurred in Case 16 after operation. As the patient
lived for six months, and as the necropsy showed, it
could not come from erosion of the bowel. I have reported
one case—a patient under the care of Dr. Palmer Howard—in
which, in a robust, strong man who had had intense
backache, death occurred suddenly from rupture into the
duodenum. Pressure on this part may lead to great dilata-
tion of the stomach. I saw with Dr. F. J. Shepherd an
elderly lady with great distention of the abdomen, dilatation
of the stomach, with severe pain and anæmia. The necropsy
showed an enormously dilated stomach due to pressure of
an aneurysm on the duodenum. While revising this paper
Professor James Ritchie showed me an aneurysm of the
aorta just as it passed through the diaphragm which had
compressed the cardiac end of the stomach causing great
dilatation of the oesophagus.

Diagnosis.—The obscurity of the symptoms in aneurysm of
the abdominal aorta has been recognised by all observers.
It is well illustrated in the Guy’s Hospital statistics. ‘‘A
correct conclusion during life as to the nature of the disease was arrived at in 18 only out of the 54 cases on which this lecture is based, an analysis showing that an abdominal tumour was detected in 31, pulsation in 35, expansile pulsation in eight only, and a systolic murmur in 26. Incorrect diagnoses of a variety of diseases were made, including malignant tumours lying in front of the aorta, renal calculus, lead colic, spinal caries, sarcoma of the kidney, nephritis, perinephritis, pneumothorax, pleuritic effusion, epithelioma of the oesophagus, malingering, chronic intestinal obstruction, &c."

As pulsation or throbbing, evident to the eye of the observer, or felt by the patient, is the most obvious feature of the disease, it will be well to consider briefly in what circumstances pulsation occurs in the abdomen. Normally, as one looks at the abdomen of a person in the recumbent posture, pulsation is visible between the ensiform cartilage and the navel. It may be slight, even absent, but in a majority of individuals it is present and in spare subjects in two special areas, an upper, at the ensiform cartilage or in the right costo-xiphoïd angle, and a lower, just above and a little to the left of the navel. These may be separated by an area in which no pulsation is visible but they are often continuous. In favourable subjects one can see that the upper pulsation precedes the lower by an appreciable period of time. After running 100 yards quickly the chief impulse is at the ensiform cartilage, representing the throbbing of the dilated right chambers which are close to it. In overdistension of these chambers, particularly in the hypertrophy and dilatation of valvular disease, the beating in what we call the pit of the stomach is very evident and may be associated with a subjective sensation very distressing to the patient. The actual impulse itself is rarely cardiac but is due to the pushing down and out of the left lobe of the liver.

Sometimes the pulsation is actually cardiac, due to the protrusion of the abdominal wall by the right ventricle. This may occur in great dilatation, as Morgagni observed. The diaphragm may be pushed down and at each impulse of the heart the ensiform cartilage and the skin below it are pushed out so forcibly that the condition is mistaken for aneurysm of the upper abdominal aorta. I have seen in disease of the mitral valve the dilated right ventricle cause a large pulsating tumour below the ensiform cartilage. In one patient at Mount Sinai Hospital, seen with one of the house physicians, a woman with mitral stenosis and enormous hypertrophy and dilatation of the right heart, the question was raised as to the existence of an aneurysm of the heart. In another instance in a boy, aged five years, seen on April 18th, 1895, with an extreme degree of mitral disease

5 Bryant: Clinical Journal, 1903.
6 Seventeenth letter, twenty-eighth article.
and great hypertrophy of the heart, the note is worth quoting: "Apex beat is in sixth and seventh interspaces, forcible, widespread, and extends laterally to the mid-axillary line. The praecordial bulging is marked, and below the left costal margin, projecting for 4 cm. and occupying the whole of the left quadrant of the epigastric region, is a prominent heaving, pulsating projection of remarkable dimensions. During coughing it becomes very much larger. In this there is a very loud systolic murmur and a rumbling murmur in diastole." It was perfectly evident that this projecting tumour was only part of an enormously distended right ventricle, not an aneurysmal tumour, as the impulse was synchronous with the apex beat and was directly continuous with the wide-spread throbbing of the heart. The cardiac epigastric tumour may be central and of a remarkable prominence. The beating of the aorta is most evident when the vessel becomes more exposed in the lower half of the epigastric and in the upper umbilical areas. In well-nourished persons the pulsation is slight and the vessel cannot be easily felt. In enteroptosis and great emaciation the vessel may be rolled under the finger as a distinct tube, feeling of about the size of the index finger, and may even be readily grasped. In rare instances the vessel is seen; even the bifurcation may be visible. In a patient with extreme anorexia nervous the vessel with its bifurcation showed in a photograph.

Abnormal aortic pulsation is met with under the following conditions. First, in neurotic and hysterical states, chiefly in women. I suppose there is no young physician who has not diagnosed as aneurysm of the aorta the preternatural pulsation of the vessel, as Allan Burns calls it. In any suspected case it is well to be sceptical, particularly in women, in whom aneurysm is excessively rare. The subjects of this remarkable pulsation are usually neurotic, sometimes definitely hysterical. They complain of pain in the back and at the occiput and have the usual symptoms of nervous exhaustion and debility, but the special feature upon which all their feelings centre is the throbbing in the abdomen, which may be so severe as to interfere with their sleeping or even with the taking of food. In extreme cases there are pain, shortness of breath, and even remarkable attacks of hæmatemesis. It is stated that Hippocrates had noticed this pulsation, but to Morgagni we owe the first accurate description. Allan Burns \(^7\) gives a very careful account of the condition and quotes from Albers, of Bremen, a remarkable instance in which, associated with the throbbing, there was passage of dark blood in the stools. The association of small haemorrhages from the stomach and intestines has been described by Sidney Phillips \(^8\) but I have seen no reported case more remark-

\(^7\) Observations on Diseases of the Heart, &c., 1809.
able than that of Albers. The girl was excessively neurotic, had fainting fits, great palpitation in the abdomen, and an astonishing degree of violent pulsation. She had passage of blood from the bowels and the diagnosis of aneurysm was made, but a Dr. Weinhalp, who was called in, said he doubted if the pulsations proceeded from aneurysm as he had read of similar cases in Morgagni. The points to be borne in mind in these cases are: (1) That the pulsation occurs in nervous or hysterical women or in neurotic or hypochondriacal males. In mild forms it is common. (2) The subjective sensations may be pronounced—pain, abdominal distress, nausea, sickness, constipation, and, in some instances, the vomiting of small quantities of blood and the passage of blood in the stools. (3) The degree of visible and palpable pulsation may be extreme. The abdominal aorta is easily palpable and may be grasped in the fingers. It is sometimes tender. No definite tumour is felt. With much anaemia a thrill may be present. A soft systolic bruit may be heard, even without any pressure of the stethoscope. A mistake is not likely to occur if it is remembered that no pulsation, however forcible, no thrill, however intense, no bruit, however loud—singly or together—justify the diagnosis of an aneurysm of the abdominal aorta, only the presence of a palpable, expansile tumour.

Secondly, preternatural pulsation in the upper portion of the abdomen may be associated with tumours. In cancer of the stomach it is quite common to see a diffuse impulse in the left half of the epigastric or in the upper quadrant of the umbilical region. In the large, flat carcinoma of the stomach the impulse may be very forcible, but it is not expansile, and there is rarely any difficulty in determining that it is not aneurysmal. Cysts and solid tumours of the pancreas, cysts and tumours of the mesentery, and solid tumours of the retroperitoneal glands may be associated with a widespread impulse in the upper part of the abdomen. The greatest difficulty is encountered in comparatively small tumours directly over the course of the vessel, as in thin persons the throbbing may be so pronounced that, with a thrill and bruit, often present, the resemblance to aneurysm may be very close. As Allan Burns remarks, a tumour placed over the course of an artery and attached to it pulsates more strongly than the vessel itself. It can usually be noted in thin subjects that there is no actual expansile pulsation in the tumour itself.

Thirdly, in anaemia. In extreme anaemia there is throbbing of the arteries, both visible and palpable, and the pulse may even have the Corrigan or "water-hammer" quality. The most extreme throbbing may be seen and felt in the abdominal aorta, and it is not infrequently a source of great distress to the patient. The impulse may be bounding, striking the hand with extraordinary force, and when associated with a thrill and a bruit it may suggest aneurysm very
strongly. I have reported a case in point. On June 13th, 1885, I saw with Dr. Whiteside a large, stout man, aged 45 years, who had had for some months dyspepsia and pains in the abdomen of exceptional severity. He was anæmic and sweating and looked as though he had had a hæmorrhage. The large and fat abdomen throbbed in a most extraordinary way. The maximum impulse was a little below the ensiform cartilage, but from this point a large wave of pulsation passed over the whole abdomen. The shock was communicated to the patient’s body and one could see the jar in the head and in the feet. Standing against the foot of the bed I could feel distinctly the impulse jarring the entire bed. On palpation the throbbing was violent with each systole, but it was trifling in comparison with the extent of visible pulsation. There was no expansile movement. No tumour could be felt. A systolic murmur was audible.

That evening shortly after my visit the cause of the sudden anæmia became evident, as he passed a large amount of blood by the bowel and vomited blood. In the morning and for the next three or four days he vomited and passed large quantities of blood per rectum. The necropsy showed a duodenal ulcer lying directly upon the pancreas and the aorta, with thickening about it. The aorta itself was perfectly normal.

Fourthly, as pointed out by Stokes, the aorta may throb so forcibly in aortic insufficiency that aneurysm is suspected. It is a good rule never to diagnose aneurysm of any part of the aorta in young persons, particularly if anæmic, with insufficient aortic valves. Pulsation of extraordinary force, thrill, and bruit may all be present in an abdominal aorta which, post mortem, shows neither dilatation nor disease.

In old men with thin abdominal walls a very sclerotic aorta may suggest aneurysm. Among other causes of abdominal pulsation may be mentioned regurgitation of blood along the inferior vena cava. Allan Burns refers to a case of this kind, described by Senac, in which the vena cava was as large as the arm and the patient had a very violent pulsation in the epigastrium. I have not been able to find the original report.

In the diagnosis of aneurysm of the abdominal aorta perhaps the greatest difficulty arises when the sac has ruptured behind the peritoneum with the gradual formation of a large tumour, filling the upper part of the abdomen, or one or both flanks, and in which there may be little or no pulsation. While attention was called to this circumstance years ago by Stokes, that it warrants more careful consideration is shown by the frequency with which the condition is overlooked, and the extreme gravity of an operation upon what is supposed to be some form of new growth. Among the Guy’s Hospital series Dr. J. H. Bryant gives cases in

9 Canada Medical and Surgical Journal, March, 1887.
which the ruptured aneurysm was mistaken for renal calculus (owing to the agonising pain extending down in the left groin and to the testis), renal sarcoma (operated upon), cancer of the oesophagus, lead colic, and malignant disease of the liver.

There is perhaps no more tragic event in operative surgery than unwittingly to open an aneurysm. It has been done by past-masters of the craft. Pirogoff's comment on such a case has always appealed to me very strongly: "There are in everyone's practice moments in which his vision is held so that even an experienced man cannot see what is nevertheless perfectly clear. At least, I have noticed this in my own case. An overweening self-confidence, a preconceived opinion, vanity, and weariness are the causes of these astounding mistakes."

Nowadays when laparotomy is so common this form of aneurysm in the abdomen has been operated upon not infrequently. The suddenness of the onset of the pain and its great severity and the absence of pulsation in the tumour are very apt to lead one astray. In Case 2 in which there was an exploratory aspiration we had no idea that it was an aneurysm. I have not looked specially into the literature of the subject but I have had my attention called to several cases. Dr. Williams of Buffalo showed me two specimens, both from patients operated on for abdominal tumour without any idea of the presence of aneurysm. Lockett of Jamaica operated on a large abdominal tumour supposed to be associated with the liver but he found a large non-pulsating aneurysm of the abdominal aorta. While revising this paper for the press a man was admitted to the Radcliffe Infirmary under the care of Dr. E. C. Bevers with great pain and swelling in the right iliac fossa. He had been in one of the London hospitals with renal colic. An operation for suspected appendicitis revealed the presence of a large retro-peritoneal blood tumour which followed rupture of an abdominal aneurysm.

As the three cases in my series illustrate many important points in this form of the disease I shall report them in full.

**Case 2. Pain in the back for nearly a year; admitted with an enormous abdominal tumour, projecting at the back and flank; no pulsation; thrill and rasping murmur in the epigastrum; extreme emaciation; rapidly growing sarcoma suspected; aspiration; necropsy; large diffuse aneurysm.**

(Figs. 1 and 2.)—The patient, a coloured woman, aged about 36 years, was admitted on Sept. 10th, 1894. She had been married eight years, had had four children, two still-born. Her present illness began in October, 1893, with pain in the small of the back. About February, 1894, she noticed a rounded swelling like a small knob on one of the lower ribs.

It was immediately under the skin but she could not say whether it was on a rib or between two ribs. In April, 1894, she went to the Pennsylvania Hospital and was confined to bed until August. For the past three weeks the tumour had grown with great rapidity. The chief trouble appeared to have been pain, which at first was continuous and later had been what she called "a jumping ache." She had had to take much morphine for the pain. The patient was extremely emaciated. The most striking feature was a very large tumour on the left side of the abdomen, causing great bulging in the flank and back. The drawing made by Max Broedel (Fig. 1) illustrates better than any description the remarkable appearance presented by this mass. There was no pulsation but in the epigastrium there were a loud thrill and a very rasping murmur. A suggestive feature was that the heart sounds were transmitted to the large tumour just below the costal border. It seemed everywhere firm and resistant, though midway between the costal border and the crest of the ilium there were several softer spots to be felt. The skin over the mass was very glistening, not hæmorrhagic. As the nature of the tumour was quite doubtful, on Sept. 15th she was given ether and Dr. Halsted made an exploratory aspiration. A thin blood-coloured fluid was drawn off and the needle seemed to enter a large cavity. A few days later oozing began from the point of puncture and there was a central spot of softening, which gradually enlarged and discharged a very offensive material. The patient died from exhaustion on Oct. 1st.

**Fig. 1.**

Appearance of the diffuse aneurysm in Case 2, seen from behind.
Necropsy.—At the post-mortem examination the body was 150 centimetres long; there was no oedema. The abdomen was swollen. On the left side, extending from the crest of the ilium to within five centimetres of the axilla and occupying the entire thickness of the lateral aspect of the body, was a tumour mass of rather soft consistence. The epidermis over the tumour was peeling off and in the centre there was a slight defect from which blood-stained serum might be pressed. The orifice of this defect did not exceed two millimetres in diameter. The whole tumour bulged outwards and had a convex surface, the apex of the convexity being at the point of skin defect. The surface tapered towards the ilium on the one side and towards the axilla on the other. The subcutaneous fat was almost absent; the muscles were very thin. There was no excess of

Front view of Case 2. a, Marks the site of a loud rasping systolic murmur. b, Level of the ninth rib. c, A large, rounded, glistening mass; very firm area under the ribs. d, Soft spots to be felt in this region. e, Level of crest of ilium. X, A small mass which appears to be separated from the larger mass.
fluid in the peritoneum. Bulging into the peritoneal cavity on the left side was a continuation of the tumour seen externally. It had displaced the left kidney and spleen, which occupied its superior surface—the kidney below, the spleen still covered by the diaphragm. The kidney could be separated and formed no essential part of the tumour mass. It was somewhat flattened on the side next the tumour. The ureter was of normal size. The spleen was bound to the diaphragm by old strong adhesions and by similar adhesions to the left lobe of the liver and less firmly to the tumour mass. The tumour mass projecting into the peritoneal cavity was as large as an adult head and reached in its upper portion nearly or quite to the median line. So far as the peritoneal cavity was concerned it was entirely behind and covered by the peritoneum. From just below the diaphragm the aorta was lifted up and ran over the anterior surface of the tumour in the median line. There was nothing of any moment in the condition of the thorax and abdominal organs except that there were numerous gall-stones with some peri-splenitis and slight peri-hepatitis. As regards the heart and aorta the heart was small; the endocardium was slightly stained with bile; all the valves were normal; the muscle was pale; the coronary arteries were normal. The right cavities were filled with coagulated blood. A large sacculated aneurysm sprang from the abdominal aorta above the renal vessels and had ruptured on the right side, forming an enormous blood tumour filled with clots.

CASE 3. For nearly two years pain in the left side of the abdomen, constant, and in paroxysms; large tumour in the left flank, increase in size; great increase of the pain; incision of tumour with an attempt made to reach the abdominal aorta; death on the operating table. (Fig. 3.)—A man, aged 33 years, was admitted to Ward E on April 13th, 1896, complaining of attacks of severe pain in the left side of the abdomen. He had had urethritis 12 years previously; he had never had syphilis; he was a temperate man. Two years ago he had attacks of palpitation of the heart and for nearly six months had some dizziness. His present illness he dated from 20 months previously, when he had first a sharp, stabbing pain in the left side of the abdomen. It was always in the same spot in the flank and came on about the same time in the day, and lasted from two to 12 hours. At first it was not very severe but at times for three or four days he would have attacks in which it was bad enough to cause him to double up with the pain. Evidently the pain had been of very great severity and had been the most constant feature in the case. The attacks would come on at any hour of the day or night. The pain started in the left side and radiated upwards and downwards towards the testicle. He described it as cutting in character and said that it was like the pain of a
boil. During a severe attack his legs were drawn up and he obtained relief by pressure on the left side of the abdomen. It was sometimes so bad that he had had nausea with it but never any vomiting. The pain was referred chiefly to the back rather than to the front and he said that he had always been more tender on pressure in the lumbar region than in the front part of the abdomen. He had very frequently had to take morphine for the severity of the pain and during the past year he thought that he had lost as much as 25 or 30 pounds in weight. He had never had any blood in the urine nor had he passed any gravel. The patient was a well-built, well-nourished man, rather pale, but the mucous membranes were of good colour; the pulse was 30; examination of the thoracic organs was negative. The apex beat was visible in the fourth and fifth interspace, in and a little outside the nipple. The maximum impulse was inside the nipple line. The sounds were clear at both the apex and the base; there
was no accentuation of the aortic second sound. The abdomen was symmetrical, tympanitic; the skin of the left side was pigmented from the application of plasters, &c. The recti were held very tense. Pressure behind in the lumbar region caused a good deal of pain. On bimanual palpation in the left flank there was felt on deep inspiration what was thought to be the left kidney. Pressure caused a good deal of pain. There were no enlarged glands in the groin. There was marked sclerosis of the veins of the right leg. The testicles and epididymides were normal. This note was made by Dr. Harold Parsons the day after admission. The urine was amber-coloured; it was of specific gravity 1024 and contained no albumin or tube casts. On April 19th Dr. Thayer noticed that there was a resistant mass which could be taken between the hands in the left renal region, very tender on pressure. The abdominal muscles were, however, so rigid that thorough examination was not possible. Early on the morning of the 20th the patient was awakened with a very intense pain in the left side of such severity that he required morphine hypodermically. At the time of the visit the muscular resistance on the left side of the abdomen was very marked. The patient complained of great pain on pressure in front and more particularly behind. On deep inspiration nothing could be seen and on palpation nothing more definite was to be felt than was noted on the 19th. On the 22nd, at 5 P.M., the patient began to have very severe pain in the left side, similar, he said, to the pain of his ordinary attacks but much more intense than he had ever had before. At 5.30 Dr. Thayer dictated the following note: "In left side of abdomen there is now a large tumour occupying the entire flank, extending to the umbilicus and reaching almost to Poupart's ligament. It emerges from beneath the costal margin at the ninth rib. The normal depression of the flank is converted into a convexity. The greatest prominence is about midway between the anterior superior spine and the navel. On inspection it is seen that this presents a well-marked pulsation, particularly in the flank between the ribs and the crest of the ilium, and to a less extent as far over as the middle line. The tumour is uniformly dull, and there is a good deal of tenderness on pressure." (Fig. 3.) The mass had a boggy, semi-fluctuating feel—particularly at X in the figure. The patient found a good deal of relief by having the left leg drawn up, and there was some pain down the back of the leg, particularly when extended. Rectal examination was negative. The face looked blanched; the pulse was 120. The red blood corpuscles were about 3,000,000 per cubic millimetre; the leucocytes under 5000 per cubic millimetre. A needle inserted into the most prominent part of the mass obtained only a few drops of blood. On April 23rd the patient had had a fairly comfortable night. Dr. Thayer noted that the patient's complexion had become more sallow and had a slightly yellowish tinge. The tumour
on the left side was not quite so prominent. The pulsation in the upper part was, however, more marked, and at the point of maximum pulsation there was a single shock heard but no murmur. There was a very suspicious fluctuation in the mass, the outlines of which remained very much the same as the day before. When the patient turned on his right side the expansile character of the pulsation was very evident. The recurring attacks of pain, the progressive loss of weight, and the appearance of a tumour in the flank were suggestive of new growth, and it was thought possible that the pulsation might be due to extreme vascularity. The other possibility was an aneurysm of one of the branches of the abdominal aorta, or of the aorta itself, and this view was favoured by the rapid appearance of the growth and the marked impulse. The patient's condition became desperate and he urged that something should be done. Dr. Halsted determined to try to reach the abdominal aorta. Accordingly the tumour was fully exposed by median incision and was found to be an immense retroperitoneal blood cyst occupying the left half of the abdomen, with the colon passing along its right margin. A large mass could be felt high up. The aorta was exposed and an attempt was made to compress it. As the large clots turned out they were followed in a moment or two by a gush of bright arterial blood and the patient died instantly.

**Case 16. Pain in the side; formation of a tumour; sac wired; melena, three attacks; gradual improvement; four months later severe pain with rapid increase in the size of the tumour, which filled the entire left side; death from exhaustion; necropsy, huge diffuse aneurysm (Fig. 4).** — The patient was a man, aged 49 years, by occupation a bar tender. He was first admitted on March 23rd, 1899, with acute lobar pneumonia. At that time he denied ever having had syphilis. The course was uneventful and he made a complete recovery. There was nothing to indicate an aneurysm; he complained of no pain; no mass was felt in the abdomen. The involvement was of his left lower lobe and there occurred a slight pleural effusion, straw-coloured fluid being withdrawn by the aspirating needle. The patient was readmitted on April 16th, 1904. Since the previous admission he had been a cook; he had had to lift heavy pots and kettles and had been exposed to rapid changes of temperature. He had been in the habit of drinking one bottle of beer daily but no whisky or gin. On the previous admission, however, he acknowledged having been a pretty heavy drinker as a young man. He again denied syphilis; no history was to be obtained of secondary symptoms. The onset of the present illness occurred six months previously with pain in the left flank, constant, dull, and aching in character. The pain was relieved by pressing the epigastrium against the corner of the table. Ten weeks previously he was admitted to St. Joseph's Hos-
pital where a diagnosis of aneurysm was made. At this time he had pain in the left testicle and adjacent portions of the thigh. The pain was increased by lying on the left side and also by over-eating. The appetite had been good and except for the symptoms mentioned there had been no distress; there was no loss of weight. On admission the heart was slightly enlarged; the second aortic sound was markedly accentuated and ringing. The arteries, brachials and radials, were definitely felt, but not markedly sclerosed. The temporals could not be felt. On April 19th the following note was made: 'Healthy-looking, fairly robust man. Arteries are a little thickened. He looks as if he had lost a little weight. Pulsation in upper abdomen and left hypochondrium; maximum at junction. Pulsation a little more to left than to right. Cardiac pulsation corre-

FIG. 4.

Reproduced from a photograph of the tumour in Case 16.
The aneurysm has lifted the left costal arch and fills the whole of the left side of the abdomen.

sponds closely with abdominal pulsation; abdominal pulsation a trifle behind cardiac pulsation. No difference between infracostal grooves. Pulsation and shock reached to, but did not lift, the ensiform. The pulsation was seen as far as navel. Lessened on deep breathing. No pulsation in back. Palpation; forcible pulsation with the hand on epigastrium; maximum about the centre. No thrill. No marked tenderness. As the fingers pass deeply in there is a very positive expansile pulsation; more marked to the left; felt 2.5 inches from median line. Tumour mass is definitely felt, particularly to left, as far as nipple line; large, rounded, cannot be felt to same extent to right; can be felt below, where there is a very definite thrill. Short, rough systolic murmur heard everywhere over the tumour; maximum just about the centre; diminishes in intensity
toward ensiform; heard at the back. Heard much more loudly to the left. Aortic second sound ringing. No tumour in flank itself; one can pass hand deeply into renal region. Femorals are both pulsating.” On the 22nd the blood pressure in the dorsalis pedis arteries was—right 210 millimetres, left 200 millimetres. On the 29th the aneurysm was wired by Dr. Finney. An incision was made at the border of the left rectus; the sac was exposed with considerable difficulty. On palpation the sac was found to have a rather wide base. 11 feet of silver wire were inserted; a current of ten milli-ampères was passed for 15 minutes. The incision was closed. Some pain was present after the operation, principally in the distribution of the ilio-inguinal nerve. On May 2nd the pain was more severe. On the 5th haemorrhage from the bowels of about 100 cubic centimetres of clotted blood took place. There was no change otherwise. Some vomiting occurred during the next few days but no blood. The first dressing was done on May 9th. The wound was healed perfectly; pulsation was apparently more marked than before the operation; the tumour mass was more prominent. A well-marked thrill and bruit could be heard over it. On the 27th a second intestinal haemorrhage took place. The patient was having much pain and at times was irrational. On the 28th there was a third haemorrhage of 150 cubic centimetres. On June 24th it was noted that the patient was doing well; he was a good colour. The tumour seemed less prominent and felt very hard. The spleen was pushed over to the left. A systolic bruit could be heard to the right of the line of incision but not to the left. Behind there was a very marked pulsation. There was a little bulging in the lumbar region. Pulsation was visible at and beneath the eleventh rib; pulsation was also felt. On August 21st the patient had more pain than usual. He slept with morphine but on the following morning his face appeared rather blanched; there was some fullness in the left flank which was extremely tender. Pulsation of the aneurysm was less than on the previous day. On the 23rd it was noted that below the sixth inter-space in the mid-axilla, throughout the left lumbar region and extending forward to within 7·5 centimetres of the mammary line, was an area of flatness. The mass in front was not more prominent than it had been but pulsation was not quite so visible. There was considerable tenderness over the original mass. Over the mass in the flank, however, the tenderness was very marked. This whole prominent mass in the flank was pulsating but no bruit was heard over it. The bruit previously heard in the hypochondrium and epigastrium was not present. The blood count had fallen from 3,800,000 to 2,520,000. It was thought that a rupture had taken place into the retroperitoneum. This became more evident during the next few days, the mass in the flank increasing in size and being directly continuous with the tumour previously felt in front. On the 26th it was noted that the whole
mass pulsated. The following note was made on Oct. 7th: "Large tumour filling whole flank, lifting costal margin. Pulsation remarkably diffuse, visible from lower border of sixth rib to iliac crest and as far over as navel. Tumour has lifted whole costal margin to sixth and seventh interspaces. It bulges in the flank. The pulsation is definitely felt and lifts the finger. Bimanual palpation definitely expansile. No diastolic shock. Loud murmur in middle line, heard along left costal margin, becomes feeble in flank. Second sound heard over front of tumour." Some diminution in the size of the tumour was noted during October and November. On Oct. 10th the patient began to have some fever, the temperature rising to 102°F. On Nov. 13th and 14th it was noted that the tumour was somewhat larger, extending forward farther in the epigastrium. The pain, which was always severe, became worse; the patient's general condition became more serious and he died on Nov. 16th.

**Necropsy.**—At the post-mortem examination (which was performed by Dr. MacCallum) the following condition was found: aneurysm of the abdominal aorta; encapsulated haematoma; erosion of the vertebrae, ribs, and ilium; destruction of the left kidney and adrenal, with obliteration of the renal artery and ureter; cavernous angioma of the liver; chronic diffuse nephritis; and oedema of the lungs.

There are several points to which reference may be made in these cases. The enormous size of the tumour in Case 2 and the absence of pulsation, the rapid growth, the emaciation, and the anaemia led to the diagnosis of a new growth. The blood obtained on aspiration did not contra-indicate this, as blood is often withdrawn from sarcoma. The irregular masses in front were also suggestive of tumour. The thrill and bruit should perhaps have aroused suspicion but the former, at least, is not infrequently heard over tumours. The absence of pulsation is probably met with when, as in this case, the haematoma is enormous and the patient is weak from loss of blood. The same mistake was made by Stokes (Case 80 in his book on the Heart) in a patient with enormous effusion into the mesocolon. In Case 3 the increase in size of the tumour was so rapid that the same mistake was not made. One has to bear in mind, however, that expansile pulsation, quite forcible too, is felt in large sarcomata, more particularly in the big growths from bone, as in the iliac region and the thigh. Even when the sac, as in this case, is laid open the presence of blood and transformed leathery clots is not conclusive evidence for aneurysm. There are old sarcomata among abdominal tumours in which the greater part of the growth is made up of altered reddish-grey, dry blood clot, not unlike that of an aneurysmal sac. Such a case I reported to the Philadelphia Pathological Society in 1886. In Case 16 we had an opportunity of studying the gradual formation of the
secondary tumour which reached a very large size and then shrank a little. The primary tumour has been observed to diminish in size after rupture. The attitude of the patient is sometimes very remarkable. In Case 16 the patient lay for months with the left thigh drawn up and it was impossible to extend the leg. Rapid anæmia, emaciation, and slight fever follow rupture with the formation of a large hematoma and these features, added to the presence of a large abdominal tumour, naturally suggest a new growth.

Treatment.—We cannot expect to do much towards the cure of internal aneurysm. Nature occasionally cures a case. I have seen at least two instances of spontaneous healing in aneurysm of the abdominal aorta. Now and again the physician is able to effect a cure. I have not been so fortunate to see such a case. In a few instances the surgeon prolongs life or even effects a complete healing. In the cases here reported the general measures were carried out which are believed to favour coagulation in the sac. We have given them a very full trial, particularly the combination of rest with low diet. Three cases received very full and thorough treatment with gelatine without much benefit. In Case 4 it seemed to do some good and relieved pain. A point of interest in this series is the large number of cases treated surgically. I have to thank my colleague, Dr. Halsted, for his kind interest, and his associate, Dr. Finney, to whom he handed over most of the cases. Dr. Hunner, also, has been helpful. In Case 1 an exploration was made to determine whether anything could be done. The tumour was so moveable that it was thought to be connected possibly with one of the branches of the abdominal aorta, but it was found to spring directly from the vessel itself. The sac seemed so solid, and the old man's condition was so good, that it seemed best to do nothing. In Case 2 a large, diffuse aneurysm was punctured for diagnostic purposes. The three special surgical measures which have been introduced are: ligation of the aorta, compression of the vessel above the sac, and the insertion of foreign material into the sac to promote coagulation with or without electrolysis. In Case 3 an attempt was made to reach the abdominal aorta and to compress it. The sac was opened freely and large clots were turned out, but before the vessel could be compressed above it there was a sudden gush of bright scarlet blood and the patient died suddenly.

There have been about a dozen cases of ligation of the aorta for aneurysm, all, I believe, fatal. Dr. Keen in reporting his case (the twelfth) gives the literature.¹¹ Compression above the sac has been more successful and in the well-known case under Dr. Murray of Newcastle, operated upon in 1863,
the aneurysm was cured and the patient remained well for six years. In 1864 Mr. Moore of the Middlesex Hospital attempted the cure of aneurysm by the insertion of a foreign body, since which time this method of procedure has been extensively practised and has been modified by Corradi who passed an electric current through the wire. The technique of the operation has been much improved, particularly by Dr. D. D. Stewart of Philadelphia and by Dr. Finney and Dr. Hunner, and in the *Johns Hopkins Bulletin* for 1900 the latter has given a description of the method which has been used in this series. In seven of the cases the sac was wired and an electric current was passed. The results have been as follows: Case 5 died 48 hours after from rupture of the sac into the pleura. Case 8 died on the ninth day from hæmorrhage into the peritoneum. Case 10 was discharged at the end of four weeks, improved; no subsequent history. Case 11 died on the fourteenth day from rupture of the sac. Case 12 was much improved; the pain had diminished, the pulsation was lessened, and he was discharged at the end of a month; no subsequent history. Case 13 was the most satisfactory in the series and may be referred to at some length. The patient was a young man under 30 years of age at the time of onset. When admitted he was suffering greatly and had severe gastric symptoms. The operation was followed by marked improvement, reduction in the size of the sac, disappearance of the pain, and complete relief of the nausea and vomiting. He returned to the hospital every year for a few weeks. At the last visit the sac had increased in size and three and a half years from the date of the operation he died from rupture of the sac. In Case 16 there were three hæmorrhages from the bowels after the operation but for two months there was improvement. Then rupture occurred into the retroperitoneal tissues with the formation of a large tumour filling the left side of the abdomen. Death occurred six and a half months after the operation.

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