the divisions, instead of following the law of tangents and becoming rapidly closer after the first ten or fifteen, by a peculiar arrangement of the coil and needle, are spread out in the portion of the scale most frequently used, adding considerably both to the ease and to the delicacy of observation.

It is obvious that current-measurement is necessary to develop the therapeutic use of electricity, the action of any remedy being only ascertained by accurate estimation of the dose administered. When the chemical action of the current is solely utilised, as in the treatment of aneurism by electrolysis, current-measurement becomes imperative. The want of definite knowledge on this subject induced me to investigate experimentally the formation of blood-clots by the voltaic current. The experiments were made with human blood and with that of the lower animals, to which various chemical reagents were added to retard or prevent natural coagulation. A few observations were taken with horses' blood, which retains its fluidity sufficiently long for experiments to be made without the addition of preventives to coagulation.

An apparatus was constructed so that two or more platinum or steel wires of equal diameter, placed at equal distance apart, could be immersed into the blood to a known depth. The current, measured by one of my galvanometers, was allowed to pass for a definite time, observations of the current-strength being taken every minute; the resistance ranged from 750 to 2260 Ohms. At the conclusion of each experiment, the clot formed on the anode was thoroughly drained on filtering-paper and accurately weighed. The observations of the current-strength, together with the weight of clot, were then reduced to a common mean, giving the weight of clot formed per minute by a current-strength equal to the one-hundredth of a Weber. The deposit round the cathode, being from more than coagulum, was not estimated. In some experiments, another apparatus was employed. A portion of the aorta of a cow, immediately after the death of the animal, was filled with blood and a needle connected to the anode inserted into it, the cathode being attached to a piece of tinfoil placed on the external surface of the artery.

The difference in the clots formed by relatively large and small currents was ascertained—(1) by taking the specific gravity of the clots in oil, and reducing the result to the usual standard—distilled water; (2) by re-weighing the clots when they were thoroughly dried; (3) by microscopic examination of the texture of the clots after washing them free from corpuscles; (4) by general observations of their consistence and tenacity.

In order to ascertain the effects of variations in the density of the current—that is, the proportion the current bears to the area of the electrodes—two depositing cells containing blood were set up "in series". In one cell, two wires were immersed five-tenths of an inch; in the other, similar wires were immersed only one-tenth of an inch; the current-strength passing through each cell being necessarily the same. The experiment was varied by substituting for the larger wires slips of platinum foil exposing an area of three-tenths of a square inch. The clots obtained were examined after the former manner.

Table showing the Mean Weight and Specific Gravity of Clot deposited per Minute by a Current-Strength equal to the one-hundredth of a Weber. Mean Temperature 69.5 deg. Fahr.

Metal forming Electrodes.	Weight of clot in grains.		Loss per cent. on drying.	Specific gravity.
	Recent.	Dry.		
Platinum.....	.1397	.0333	76.163	1.025
Steel.....	.1092	.0408	62.683	1.140

The conclusions drawn from a number of experiments conducted after the methods above indicated may be briefly epitomised. *The rate of clot-formation is in direct proportion to the current-strength.* With a complex fluid like blood, there is great difficulty in ascertaining this proportion with precision. Without great care, the means taken to keep the fibrin in solution introduce errors seriously affecting the results. *The specific gravity of electrolytic clots is inversely proportional to the strength and to the density of the current.* There is, however, practically little difference in the general character of the clot produced within the limits of current-strength usually employed in the treatment of aneurism.

Clots formed on platinum wires were found to be more bulky and of greater weight, but of less specific gravity, than those formed under like conditions on steel wires. The increase in bulk is due to porosity of the clot produced by the presence of free oxygen. When steel wires are used, the nascent oxygen combines with the iron. On reference to the table, it will be seen that clots deposited on steel needles after desiccation exceed in weight those deposited on platinum. The excess in weight is produced by oxidation of the anode, and by the consequent presence of oxide of iron in the clot.

With a weak or medium current, clots formed on steel wires are more friable than those formed on platinum. When the current-strength is great (.05 Weber), the deposit on steel wires is pasty. Platinum clots, when moist, bear a considerable amount of pressure without disintegration; steel clots, on the contrary, break up under moderate pressure; this difference exists in clots produced by medium currents. With the use of steel needles, the current-strength rapidly diminishes, owing to the oxide of iron formed on the anode setting up a counter electro-motive force, which opposes the battery-current; with platinum or thickly gilt steel needles, the polarisation is comparatively slight.

Clots deposited from blood at 60 deg. Fahr. are not so dense as those deposited at the normal temperature (98.4 deg. Fahr.), the rate of deposition being the same.

The practical conclusions to be deduced from these investigations, as regards the treatment of aneurism, are as follows. The current-strength should not exceed .015 Weber. A current-strength equal to .01 Weber produces a firm clot, and may be theoretically taken as the standard. Currents of lesser magnitude deposit equally good clots, but necessarily require longer time to produce a given result. It is advisable to introduce two or more needles, and to connect them alternately with the anode. With gilt needles, this alternation gives time for absorption of the nascent oxygen by the circulation; if ungilt steel needles be used, the polarisation is allowed to subside, and this otherwise seriously interferes with the action of the battery.

The insulation of the needles, so far as the portion outside the aneurism is concerned, should be as perfect as possible, not only to avoid the action of the current on the extra-aneurismal structures, but also to concentrate the current on the portion of the needle within the sac.

The propriety of introducing the cathode within the aneurismal sac, or of completing the circuit by a moistened electrode applied externally, resolves itself entirely into a question of resistance; for the deposition round the cathodal needle cannot be regarded as a clot, or as in any way aiding in the consolidation of the aneurism. If a sufficient current-strength can be obtained by the use of an external cathode, it is of no advantage to introduce it within the sac. At the same time, there is no objection to the use of an internal cathode, provided the shaft is well insulated; for it must be remembered that the caustic action of the current is chiefly confined to the cathode. The hydrogen liberated by an internal cathode has been proved by experience to be productive of no evil results.

The duration of an application must depend upon the current-strength, half an hour to an hour being usually sufficient. When not contra-indicated, it is well to allow the anodal needles to remain *in situ* half an hour after detachment of the battery, in order to permit of consolidation of the clots. The needles, especially those connected with the anode, should have a rotary motion imparted to them previously to withdrawal, in order as far as possible to avoid disturbance of the clots.

My investigations upon this subject not yet being complete, I hope on a future occasion to make known the results of further experiments.

A CASE OF ABDOMINAL ANEURISM BECOMING DIFFUSED AFTER DISTAL COMPRESSION.*

By E. MARKHAM SKERRITT, B.A., M.D.Lond., M.R.C.P.,
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THE patient from whom the specimens before you were obtained was a married man, aged 31, admitted into the Bristol General Hospital on November 2nd of last year. He was a clerk, a native of Bristol; had never indulged in any kind of violent exertion; never had gonorrhoea; careful inquiry elicited no suspicion of syphilis. Four years ago, he was ill for six weeks with rheumatic fever; he had suffered from no dyspnoea until lately. The present illness began about seven months before admission, with pain over the liver and tenderness on pressure. Soon afterwards, the patient had pain about the epigastrium, and a stoppage of the bowels for seven days occurred, which yielded to purgatives; the pain was then relieved. Similar pain then began to come occasionally on each side, about the umbilicus, or in the back, gnawing in character; two or three times, there were shooting pains down the right thigh. For the last fortnight especially, the epigastric pain had been worse after food, coming on almost directly after a meal,

* Read before the Bristol Medico-Chirurgical Society.

and sometimes lasting for hours, slightly relieved by pressure. He had no nausea nor vomiting; his bowels were sometimes constipated, sometimes loose. The patient said he had lost two stone and a half in weight since his illness began. His breath had become rather short on exertion.

On admission, his abdomen was flat; the muscles were tense; pulsation was visible at the epigastrium. The aorta could be felt beating somewhat forcibly from the tip of the ensiform cartilage as far as the bifurcation, but most distinctly two inches below the tip of the cartilage; here there was a little tenderness on deep pressure. No abnormal lateral expansion could be defined. At the tender spot just mentioned, there was a slight prominence for about an inch from above down, where apparently some solid body about half an inch thick lay on the aorta; this body slipped up when the fingers were brought down. A *bruit* was heard along the aorta from half an inch below the ensiform cartilage down to four inches from the tip, most marked two inches and a half from the tip, where it was rough and rasping; much intensified by the least pressure; inaudible in the back. The iliac arteries pulsated in a similar way to the aorta, and a *bruit* was produced in them by very light pressure. The heart's impulse was weak; the sounds normal.

As the history of this case extends over nearly three months, I will merely give an outline of its more important features.

A fortnight after admission, the pain had become much more severe—occurring in violent paroxysms—chiefly in the right hip and thigh and right loin, lasting for a few minutes or for several hours. A thrill could now be felt in the epigastrium, two inches below the ensiform cartilage, where some expansile enlargement of the aorta could be detected. The *bruit* was much more distinct, and could be faintly heard in the back, opposite the first lumbar vertebra.

During the next month, there is little to note except the increased frequency and violence of the pain, which was rapidly wearing the patient out. At the same time, the tumour had become larger and more distinct, and the thrill was well marked. As the aneurism was making rapid progress, I resolved to try to cause coagulation in the sac by compressing the aorta *below* the aneurism, the situation of which made proximal pressure impossible. At the same time, I fully recognised that the prospect of success was not great, and that there would be considerable risk owing to the increased pressure that would be produced in the sac. Accordingly, on December 12th, I had the benefit of a consultation with my colleagues, who agreed that the method of treatment I proposed was the only one that would give the patient a chance of life, small though that might be.

Next day, December 13th, the bowels having been freely opened, the patient was put under the influence of ether, and at 10.50 A.M., Lister's abdominal tourniquet was adjusted, and the pad was slowly screwed down till pulsation ceased in the femorals, the middle of the pad being about an inch and a quarter above the umbilicus and two inches below the lowest part of the tumour that could be felt. The pulsation in the aneurism at once became much more forcible, and I slackened the tourniquet till the pulse could be felt in the femorals. Pulse 104, regular. In ten minutes, the pad was again down so as to stop pulsation in the femorals. At 11.26, the pulse was 108, weak and small; the tumour was rather less distinct, and no thrill could be felt, but the *bruit* was unchanged. At 11.40, a distinct thrill was again felt. At 12.40, no thrill was to be detected. At 1.10, there was a slight intermittent thrill, and the pulsation of the tumour was decidedly less marked. At 2.30, the general condition seemed as before; but on putting the hand on the lower part of the thorax on the right side, there was to be felt distinct pulsation, forcibly expansile, extending from the tenth right interspace to two inches above the iliac crest, backwards to the edge of the quadratus, and outwards as far as the posterior axillary line, corresponding to a distinct rounded bulging of the surface. The tourniquet was removed, and pulsation in the femorals was at once fully restored. The patient had been kept quietly under ether for four hours, without any difficulty; and there were no signs of disturbance from the compression, except that the urine passed soon after contained a trace of albumen.

Next day, the epigastric pulsation was less distinct, but wider; the tumour in the right loin was beating forcibly, over a rather larger area, and a faint *bruit* was heard over it, apparently conducted from the aorta.

During the next three weeks, the pain became frequent and most intense, so that the patient took daily about ten grains of morphia hypodermically. By the end of this time, the local condition was as follows. On the right side posteriorly, there was an egg-shaped pulsating swelling between the ribs and the iliac crest, about three inches long by two wide, visible on the surface, tender. On the left side, in a similar position, a pulsating tumour was now felt, bounded

above by the line of the last rib, below by the iliac crest, and reaching outwards for three inches from the spine; tender at its outer part. A *bruit* was heard over the tumour on both sides. If the hands were placed, one on each side of the body, over these prominences, they were distinctly separated at each beat of the heart.

From this time, the patient gradually sank; the pain continued; emaciation became extreme; slight cedema appeared over the swelling on the right side; and he died on January 29th, nearly seven weeks after the compression of the aorta and the diffusion of the aneurism.

POST MORTEM EXAMINATION.—On opening the abdomen, the peritoneum was found to be pushed over to the left as far as a line one inch inside the anterior superior iliac spine by a tumour lying behind it; and the viscera were consequently displaced to the left. On removing the stomach and intestines, the aneurism was exposed. It lay behind the whole abdominal cavity and beneath the psoas and iliacus muscles. It might be described as composed of two large, thick, conical masses, with their bases upwards, united at their sides for two-thirds of their length, while their free ends passed downwards to each thigh along the brim of the pelvis. The right mass was the larger, being about four or five inches thick, and reaching up to the liver its right border was uncovered by peritoneum, and filled the whole space between the abdominal wall in front and the abdominal wall behind. The tumour consisted of a large quantity of soft dark clot and dark fluid blood shut in simply by the muscular layers of the abdominal walls strengthened by fibrin deposited amongst them. The posterior wall of the aneurism was formed of the eroded spine in the middle line, and at the sides the muscles and other tissues bounding the body behind. On the left side, a conical cavity full of clot passed down beneath Poupart's ligament along the psoas into Scarpa's triangle, and then downwards and backwards for three inches towards the perinæum. The aneurism had sprung from the back of the aorta just below the diaphragm; its mouth was a smooth rounded opening three-quarters of an inch across. The limits of the primary sac could not be made out. The spine was deeply eroded at the last dorsal and first two lumbar vertebrae. The aorta was atheromatous, the arch slightly dilated. The heart was healthy.

REMARKS.—There are four chief ways in which aneurism of the abdominal aorta may be treated: by rest and diet simply; by drugs; by galvanic-puncture; and by mechanically more or less preventing the flow of blood through the sac. It was not found practicable to diet my patient strictly; he always felt much worse when taking iodide of potassium; galvanic-puncture was not admissible, as the aneurism had nowhere shown signs of approaching the surface; as, therefore, the patient was growing rapidly worse, there remained no choice, but either to let him die or to try the effect of compressing the aorta beyond the aneurism. The distal treatment of aneurism that we are most familiar with is that where a permanent ligature is put round a vessel or vessels beyond the sac; this, as is well known, has been done for aneurism at the root of the neck, when the carotid has been tied for aneurism arising close to its origin; or where the carotid, subclavian, or both vessels, have been ligatured for aneurism of the aorta or the innominate. But if proximal compression has been substituted to a great extent for the old Hunterian operation, there is no apparent reason why compression beyond the aneurism should not be used in suitable cases instead of ligature. Where the aneurism is high up on the abdominal aorta, we are limited to temporary compression of the vessel below, with the object of producing rapid coagulation in the tumour.

What chance of success has this distal compression of the abdominal aorta? One of the earliest cases in which this method was tried was Bryant's, when Lister's abdominal tourniquet was applied for twelve hours, removed for twelve hours, and again applied for four; at the end of that time, alarming symptoms set in, and the patient died in eleven hours. *Post mortem*, it was found that the intestine had been bruised by the pad, and had set up fatal peritonitis; but that the aneurism, involving the coeliac axis and the superior mesenteric, was consolidated. In the few other cases on record, no such result followed; but this one instance is enough to justify the proceeding, and to allow hopes of success, although, theoretically, the chance of consolidation is small; because in such a case, the great probability is that free circulation will be kept up in the aneurism owing to the origin of large vessels either from the sac itself or between it and the point of compression.

What are the dangers of distal compression? The only one not shared by the proximal operation is the risk of rupture of the aneurism, owing to the increased pressure on its inner surface caused by the arrest of the flow through the aorta beyond. This accident happened in the case I have related; and another instance is recorded in the BRITISH MEDICAL JOURNAL of April 21st, 1877, where the abdominal aorta

was being compressed by Heath of Manchester for aneurism of the common femoral, when death resulted from rupture of an unrecognised abdominal aneurism above the point of compression. In my case, the rupture took place into the retroperitoneal tissue; and, therefore, death did not at once result, but a false aneurism was formed, which attained an enormous size. It is worthy of note, however, that in cases of distal ligation at the root of the neck, there has often not been increased pulsation in the sac, but, on the contrary, a speedy diminution in both the impulse and the size of the aneurism. Thus, while fully recognising the risks accompanying distal compression of the aorta, we are justified in adopting this treatment with some hope of success; and more especially because we have to do with a disease that is almost invariably fatal—it may be very speedily—if left to itself. I do not consider that my patient's life was materially shortened by the result of the treatment, seeing that he lived seven weeks after it, and that, when it was adopted, the aneurism was making rapid progress and the patient was apparently fast dying from exhaustion.

A CASE OF DIVIDED UTERUS AND VAGINA.*

By JAMES MURPHY, B.A., M.D.,

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As cases of divided uterus and vagina (a condition normal in the marsupialia) are not very common, and as they possess a certain amount of interest from an embryological point of view, I am anxious to place on record a case that has recently been under my care, in which both these conditions were very well marked.

But, first, I may say a few words on the etiology of this malformation. The whole female genital canal, from the vulva to the fimbriated extremities of the Fallopian tubes, is formed out of two (originally separate) tubes, called, from their discoverer, "Müller's ducts". Now, while the upper portions of these ducts, which go to form the Fallopian tubes, remain separate, under ordinary circumstances the lower portions, which go to form the uterus and vagina, become as it were fused together at the eighth week of embryonic life; and it is when they fail to coalesce that we have developed those conditions which are known as uterus septus and vagina septa.

Mrs. T., aged 32, married for seven years, never pregnant, consulted me a little time ago about a cyst in her right labium; and, on examination, I also found the following conditions present. A septum, springing from each labium minor, a little anterior to the fourchette, extended to the uterus, completely dividing the vagina into two portions: an anterior and larger canal and a posterior and smaller one. This septum, which was at its commencement about a tenth of an inch in thickness, but gradually became thinner as it approached the womb, was composed of a strong dense tissue covered with squamous epithelium, composed of those large cells peculiar to the vagina, with the mucous membrane of which it was continuous. The anterior canal was slightly smaller than a normal vagina, and the posterior one something smaller than its fellow, but the two combined were not much larger than an ordinary vagina; for, when one canal was dilated it encroached on the other, as the septum could be stretched to a considerable extent. The vulva was normal, and the carunculæ myrtiformes were well developed round the commencement of each vagina, so that it is probable a double hymen existed. In the anterior canal was a cervix, quite normal as to situation and form, but the size a little less than usual. Through the os a sound could be passed to the extent of about two inches, but there was a slight amount of stenosis present. In the posterior canal, a small short cervix could be felt, crowded up to the anterior superior corner of the canal, and through the os a small sound could with difficulty be passed for about an inch and a half. To determine if the uterus were divided, I passed a sound through each os, and endeavoured to touch one sound with the other; and as I failed to do this, after several patient and careful trials, I think I may fairly assume that the septum exists in the uterus also. By placing two fingers in the anterior canal against the anterior portion of the womb, and pressing the fingers of the other hand on the abdomen, well down behind the uterus—i. e., by the conjoined method of examination—I could make out the fundus, which appeared quite normal, and, as well as I could determine, there was but one ovary on each side, as would be expected. By changing the hand on the abdomen to the anterior surface of the uterus, and introducing a finger into the posterior canal, the double cervix seemed once and a half as large as usual. Being anxious to determine whether she menstruated from both wombs, I requested her to come back during

a monthly period; and, on examination with a speculum, I found the catamenial fluid flowing copiously from the anterior os, and very slowly, but still distinctly, from the posterior one.

The patient was not aware of anything being amiss, except the cyst, and that she had suffered from dysmenorrhœa for the last year, which

was owing to the stenosis existing in each os. I purposely dilated the anterior one first, without interfering with the other, when the dysmenorrhœa was much relieved, but still existed to a slight degree. I then dilated the second os; and she has been quite free from pain during the four periods that have since elapsed.

The accompanying drawing, which is fairly accurate, will convey a better idea of the case than I have been able to do by words.

BATH THERMAL MINERAL WATERS: THEIR USES AND ABUSES.

By A. B. BRABAZON, M.D.,

Physician to the Bath Mineral Water Hospital.

III.

Diseases of Skin.—The types of cutaneous affections which commonly are presented for treatment in the Bath Mineral Water Hospital belong to the pustular, papular, vesicular, and squamous classes. I have also seen one or two examples of the class bullæ. Under the head of pustular, I find acne, impetigo, or impetiginous forms of eruption, affecting various parts of the body. Of the vesicular class, eczema contributes the most numerous examples; of the squamous class, lepra and psoriasis are most abundant; lichen generally represents the papular form; and the class bullæ is occasionally represented by cases of pemphigus, though the occurrence is unfrequent.

I regret that a large number of cases are discharged under the simple head of "Skin-disease", but as to more determinate classification are "anonymous". I think I may confidently say that these cases may be considered as coming collectively under the classes above named, although I am unable to place them in a more decided classification. Of pemphigus, I have had under my own care two most decided cases, in both of which, rather contrary to my expectation, the eruption rapidly disappeared under treatment. Of the pustular class, I find cases of acne discharged cured, but whether acne simplex or acne indurata is not mentioned. I should, from the pathology of the disease, expect such a result. I find also cases of impetigo, or impetiginous eruptions, discharged cured or much better; and my personal experience

* Read before the Northumberland and Durham Medical Society.