

believes in the marvellous effect of electricity and particularly of frictional or Franklinic electricity. Now electricity is no longer a mystery or not more so than magnetism and chemical affinity. There is no reason to ascribe to it any powers beyond those which may be demonstrated in the moist chamber on a nerve-muscle preparation. As a means of diagnosis the reaction of degeneration is most valuable. As an excitant to muscular contraction Faradism or the interrupted galvanic current is the most convenient agent we possess and slowly interrupted galvanism by keeping a segment of nerve in a state of anelectrotonus becomes a useful anæsthetic. But is there any reason to go beyond this and to believe that an electrical current acts otherwise than by its strictly demonstrable physiological effects on muscle and nerve?

In like manner is it not reasonable to question the vast therapeutical importance ascribed to mineral baths and waters? That cold water is an excellent thing for people in health and that hot baths are useful for myalgia and hot douches for osteo-arthritis is perfectly true; but that it can make the slightest difference whether we use water that comes hot out of the earth or that which has been heated in a kitchen boiler is an assertion that only needs stating to be ridiculous. Now is it less absurd to believe that ascertained doses of well-known salts like magnesium and sodium sulphate, sodium chloride, and carbonate, or minute doses of lithium or iron or arsenic, have any different effect when taken ready dissolved in natural water from what they have when weighed out and dissolved on the druggist's counter? If it be answered that small doses frequently repeated are sometimes more useful than larger ones taken occasionally the answer is obvious; that the patient at home can do either one or the other as his physician deems best. If it be answered that the large amount of water is a good diuretic, laxative, and diaphoretic, again we admit it, but taken in reasonable amount and in suitable cases this is what we order our patients at home; and on this score one water is just as good as another. If it be answered that some patients will not take saline laxatives and alkalies from the druggist's shop but will take them after a long journey and while listening to a band, this also is true, but bears rather on the folly of human nature than on the therapeutics of salines.

Surely we must condemn not only the exploded systems of sympathies and signatures, the Brunonian and the homœopathic, but all systems as systems and all attempts to base treatment on occult properties. The one touchstone for efficient treatment is experience, spread over many lands, prolonged for many years, attested by many competent witnesses. And the one safeguard that our Practice shall be rational and honest is that it follows the teaching of Pathology.

## CONSERVATIVE SURGERY OF THE SPLEEN:

### A BLOODLESS METHOD OF PARTIAL EXCISION PERFORMED ON TWENTY-TWO DOGS WITH TWENTY-ONE RECOVERIES.

WITH NOTES OF THE BLOOD EXAMINATIONS BEFORE AND AFTER OPERATION.

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WHILST in India my attention was attracted by the great number of people suffering from enlargement of the spleen and by the frequency with which cases of death from rupture of this organ were reported in the newspapers. The violence needed to rupture the spleen was often very slight, a gentle blow with a walking-stick, a sharp push with the hand, a slight kick with the naked foot, a prod by the end of the shaft of a carriage going at a walking pace, &c., being sufficient in many cases. Palpation revealed a greatly varied condition of the organ. It was often tender and soft, in other cases painless, hard, and resistant. In size it varied considerably, and in speaking of the native of India one might almost say that it was normal for the spleen to extend from the eighth to the twelfth ribs,

it being the exception to find the splenic dulness confined to our European limit, and in practice unless the edge could be felt below the margins of the ribs the patient was regarded as having a normal spleen. In some cases the organ extended across the abdomen and the edge could be felt in the right iliac region—as in one of my servants, a dog-boy, aged nine years—and it was not uncommon in these cases to see young boys and girls, and occasionally adults, walking about with the shoulders and head thrown back and the abdomen as prominent as in a six months pregnancy. Between this extreme and the other, in which the edge came just below the margins of the ribs, there was every gradation in size. The enlargement of the spleen interfered greatly with the person's occupation, the sufferers being markedly lethargic and indolent, anæmic, short-breathed, and often cyanosed, with but small power of endurance, and from the careful way in which they performed their work and walked through crowded streets, instinctively shrinking from any possibility of a contusion to the abdomen, it was obvious that they were always conscious of this enlargement.

In the majority of cases, and especially in the soft tender enlargements, the size of the spleen can be reduced very greatly and often brought back to nearly its original size by medicinal means—e.g., the administration of a mixture of the sulphates of quinine, soda, and magnesium in full doses, but some of the hard, painless, chronic forms resist all medical treatment and it is in these that surgery can be advantageously resorted to. These chronic hypertrophies are the cases where the total extirpation of the organ has been attended with most success and this is the operation which has been and still is advocated in these cases. But before an organ be excised a fairly extensive knowledge of its functions should exist or at least a knowledge of means by which the normal function may be artificially replaced, otherwise unfortunate results may accrue similar to those which obtained after the removal of the whole thyroid, results which were only checked by the observations and researches of Schiff, Reverdin, Kocher, Victor Horsley, and others as to the effect of the total extirpation of the organ and for the relief of which we owe so much to the brilliant discovery of Dr. George Murray. I venture here to express the opinion that in the reported cases of successful splenectomies sufficient time had not elapsed between the operation and the report to justify an assumption that no ill-effects would accrue and in connexion with this I would point out the singularly few cases in which the blood has been examined before and after operation.

The functions of the spleen are unfortunately but imperfectly known. It is stated that the whole organ can be excised without affecting the animal's economy beyond a subsequent increase in size of the lymphatic glands, but this statement I am inclined to doubt. In a litter of five healthy pups one month old the whole spleen was excised in one, the half spleen in three, and the other was kept unoperated upon for comparison (at the time I had no hæmacytometer, &c., for blood examinations); one of the partial excisions died from shock, the other two made excellent recoveries and speedily grew big and fat, growing, as it happened, somewhat faster than the untouched brother. The pup whose whole spleen had been removed remained fairly well for a short time, then gradually became emaciated and died from marasmus three weeks after operation, at which time its framework was distinctly smaller than that of the other three. In other cases where I excised the whole spleen (which, unfortunately, were operated upon only a short time before my departure from India and so did not permit of a sufficiently long supervision) the dogs suffered considerably from shock and were markedly quiet and apparently distressed for days afterwards and ate but little, conduct which was quite unlike that of the dogs upon whom other operations had been performed. Again, the following reports of splenectomies show that the condition of the blood is materially interfered with. Vulpius<sup>1</sup> states that in eleven observations after splenectomy there was a more or less rapid and pronounced increase in the number of leucocytes. In Malin's<sup>2</sup> case (extirpation for axial rotation on Jan. 2nd, 1894) the examinations on the second and fifteenth days after operation showed the blood to be normal and the patient left the hospital on Jan. 25th "in good general health." On April 28th there were 4,840,000 red and 30,000 white corpuscles per c.mm. (1 white to 161 red); 50 per cent.

<sup>1</sup> Medical Annual, 1895. Reported by Mayo Robson.

<sup>2</sup> THE LANCET, Jan. 13th, Sept. 15th, 1894, and quoted by Mayo Robson in the Medical Annual, 1895.

hæmoglobin, and a fairly considerable number of large white nucleated corpuscles varying in diameter from  $20\mu$  to  $50\mu$  and in which were contained several red corpuscles—in some twenty or more—the red cells apparently undergoing disintegration. On May 23rd (nearly five months after operation) the red cells had decreased to 3,300,000, and the white increased to 50,000 (1 to 66), this being the last recorded note of the case.

That the spleen must have important functions is shown by (1) the intimate and unique way in which the blood is brought into contact with the spleen tissue; (2) the enlargement during digestion; (3) the large rhythmical contractions and expansions; (4) the large white cells in the pulp which contain more or less disintegrated red cells, or else are coloured with hæmoglobin; and (5) the differences between the blood brought to the spleen by the artery and that carried away by the vein, the proportion of white to red corpuscles being 1 to 2000 in the former and from 1 to 60 or 70 in the latter; the blood in the vein is also said to have a higher temperature and to contain smaller, brighter, less flattened red cells which do not form rouleaux and on which water has not the same destructive power that it has on the ordinary red cell, and it also contains an increased proportion of the products of oxidation or extractives as well as hæmoglobin or its derivatives free in the plasma. The spleen, therefore, must have a most important influence on the life-history of the red cell, probably being the crematorium of untold millions of the "used up" and the health resort of the invalids. Again from the great amount of lymphoid tissue in the organ, the great increase in the number of the white cells in the splenic vein, the increase of them in the general circulation in diseases of the spleen, the leucocytosis in fevers where the organ is also enlarged, and the increase following its irritation, as will be seen in the accompanying tabular statement, it may be considered certain that the spleen is a great manufactory of the white cell.

These considerations impressed me with the great importance of leaving a portion of the spleen to fulfil its functions and led me to devise a method of partial excision, by which means the organ can be reduced sufficiently in size to ensure its being under the protection of the costal arch. In addition I hoped that such an operation might throw light upon the functions of the spleen and possibly upon some points in the etiology of malarial fever. It may be mentioned here that with the latter object in view in three cases the spleen was exposed and, to irritate the organ, Morton's fluid injected into its substance. This was done in conjunction with my friend Surgeon-Lieutenant-Colonel Lawrie, but beyond the fact that the dogs were very quiet with hot noses, accelerated pulse, and a possible slight increase of temperature for a couple of days, no result was obtained and the blood examinations were negative.

*Anatomy.*—The anatomy of the dog's spleen is very similar to that of the human being, the most marked difference being in its shape, which is more elongated, flatter, with a distinct depression or fissure running transversely from about midway along its anterior border. Its size varied considerably, chiefly with the size of the dog, but in a few cases it was fibroid; it was generally from 5 to 6 in. long, from 2 to  $2\frac{1}{2}$  in. broad, and nearly 1 in. thick. The splenic artery divides about  $1\frac{1}{2}$  to 2 in. from the spleen into branches (from four to eight in number) which spread out, like the ribs of a fan, to enter the hilus which extends lengthways along the inner surface of the spleen terminating a short distance from either end. The phrenic artery often gives off a branch which supplies the upper extremity of the spleen.

*The operation.*—Under chloroform the abdomen and thorax were well washed and the left side was shaved and rendered as aseptic as possible. An oblique incision three inches long was made an inch below, and parallel to, the margin of the ribs. The spleen was brought gently out of the wound, lower end foremost, only as far as was necessary, the upper end not being exposed except in those cases where this was the end removed. A pair of Spencer Wells' forceps was applied to the lowest arterial branch where it entered the hilus; another pair of forceps was applied to the same artery about a quarter of an inch farther from the spleen; the tissues between these forceps were then divided with scissors and two more forceps applied, as before, to the next vessel. In this way the gastro-splenic omentum was divided without loss of blood and without undue strain on the pedicle up to the level of the proposed division of the spleen (several arterial branches were left to supply the

upper end which was to be retained). The forceps on the spleen-side of the divided gastro-splenic omentum were then laid along the inner surface of the lower end of the spleen and an assistant raised this end and the forceps so that both surfaces of the spleen were well in view. At the level where it was decided to divide the organ the blood-flow through it was arrested by a continuous ligature used in the following way: a long needle threaded with fairly coarse silk twist one and a half feet long<sup>3</sup> was inserted on the inner or "under" surface about half an inch from the edge or border and passed through the thickness of the spleen, emerging on the outer or "upper" surface about the same distance from the edge; the ligature was drawn through until the ends were equal; the free end was then brought up round the border of the spleen and a "double turn" made with the two ends and drawn as tightly as possible, this "turn" being kept over the exit of the needle. The needle was then passed back through the spleen on the occluded side of the organ as close to the line of ligature as possible and an eighth of an inch to the "edge or border side" of the turn; this was done in order that the next loop should include the spleen where the needle had previously passed through, so that any oozing along this track should be stopped when the loop was drawn tight. The needle was then re-passed through the spleen from the under to the upper surface half an inch further on and a double turn again taken and drawn tight. Continuing in this way the breadth of the spleen was traversed. A reef-knot was then tied and the ends were cut short. The needle may be passed from the upper to the under surface and the turns made on the under surface, but the way described is the more convenient. The occluded end of the spleen was then cut through close to the line of ligature. Separate ligatures were tied round each portion of the gastro-splenic omentum included in the forceps, any tension on the pedicle being relieved as these were tightened.<sup>4</sup> The peritoneum and the three muscular coats were severally united with continuous sutures, the skin incision not being closed. The whole operation was completed in from fifteen to twenty minutes.

The points in the operation which I wish to emphasise are: 1. Its great facility, especially when the double turn is made by twisting the needle round the free end and so getting this double turn on the needle before drawing tight. 2. The oozing which takes place during the passage of the needle is at once checked by the coarse silk and stopped altogether when the loop is drawn tight. 3. The section of the spleen was absolutely bloodless except in one case where a middle loop had not been tied tightly enough; here bright arterial blood oozed away gently, but a similar ligature at that point, tied tightly, at once stopped the bleeding which did not exceed one drachm. 4. In no case did the ligature cut through the spleen, a little of the pulp only being expressed as the loops were tightened. In the large majority of my cases coarse silk was used for the continuous ligature, but in two or three cases stout carbolised catgut was employed. 5. The very low mortality.

In cases of rupture of the spleen which are seen in time for surgical interference this continuous ligature may be employed to arrest the hæmorrhage, but the procedure to be adopted would depend upon the extent, and position of the rupture. If the injury be of small extent, surrounding the bleeding surfaces with the continuous ligature may be the best treatment; if of larger extent, it would probably save time and be better to excise the damaged portion in the way described. This ligature will also, I believe, be found to be of service in hepatectomy and in small ruptures of the liver. As will be seen in the tabular statement nineteen dogs had the lower half of the spleen excised without a death; three dogs had the upper half removed with one death. In this list a dog that was operated upon the day before my departure from Hyderabad, to demonstrate the operation is not included, as I have no notes of its subsequent progress; Surgeon-Lieutenant-Colonel Lawrie kindly consented to look after the dog and have the blood examined from time to time. None of the dogs in which the lower half was excised appeared to suffer the slightest inconvenience or shock after the operation, they at once ran about unfettered

<sup>3</sup> The length of this will depend upon the breadth of the spleen to be ligatured. At the commencement of these operations a needle was threaded at each end of the silk, but this is unnecessary if the needle be passed in the way described, as the "double turn" brings the needle back into the right position for further use.

<sup>4</sup> In some of my cases these were applied before the spleen was ligatured across. The stage at which these vessels are tied is immaterial.



6	May 5th	Emaciated medium sized female	Lower half	May 4th	103°0	18	5,160,000	60,000	—	May 1st	103°0	34½	4,700,000	80,000	—	On May 1st the red were normal. White as above. Small variety more numerous than the large.
										" 9th	103°0	34½	3,660,000	50,000	—	Blood as described above; but on the 9th and 25th white cells, four times the size of the ordinary large variety were seen, multinucleated, with fine and coarse granules in the same cell; free amoeboid movement.
										" 13th	103°0	34½	4,000,000	80,000	—	
										" 25th	102°8	35	4,200,000	70,000	—	
										" 28th	103°0	35½	3,860,000	100,000	—	On the 28th suture sinus was laid open and blood taken from wound. The majority of white cells were three times the size of the red and coarsely granular with one nucleus. In the smaller white cell the nuclei varied from 2 to 10 to a cell and took the stain readily, the body of the cell not staining well. Four mononucleated, finely granular cells were seen about the same size as the large coarsely granular. (This examination was hardly fair as the blood was probably mixed with lymph cells from the wound.)
										June 13th	103°0	36	4,050,000	70,000	Spherule with no nucleus and faintly pigmented	On June 13th white of two kinds as above; both stained readily with methylene blue and eosine. No intermediate cells were seen. One spherical body was found, faintly pigmented; there was no apparent nucleus; it stained with methylene blue.
										" 14th	103°0	36	4,100,000	70,000	—	On the 14th nothing abnormal was seen.
										" 16th	103°0	36	4,400,000	60,000	Rosettes	On the 16th red and white were as last described. Six rosettes were found in one slide and four in another.
										" 17th	103°0	36	4,820,000	70,000	—	On the 17th there was nothing abnormal beyond three of the very large white cells.
										" 18th	103°0	36	4,000,000	60,000	Rosettes	On the 18th five rosettes were found in one slide.
										" 19th	103°0	36	4,620,000	60,000	Rosette and spherule	On the 9th one spheroidal body was found as on the 13th. A rosette was watched for half an hour and seen to change shape. One of the very large white cells was present in the same field with the rosette.
										" 20th	103°0	36	4,210,000	70,000	—	On the 20th nothing abnormal was seen.
										" 24th	103°0	36½	4,500,000	50,000	Rosette	On the 24th a rosette was seen to change shape and finally could hardly be distinguished from a large, coarsely granular white cell.
										" 25th	103°0	36½	5,000,000	60,000	Rosette	On the 25th a rosette was seen to change shape.
										July 1st	103°0	36½	4,300,000	50,000	Rosettes	On July 1st there were two rosettes on one slide. One large eosinophile.
										" 18th	103°0	36½	4,000,000	50,000	Rosettes	On the 18th there were several rosettes, one of which changed shape and finally became indistinguishable from a large, coarsely granular white cell.
										" 22nd	103°0	36½	4,820,000	50,000	—	On the 22nd the dog was handed over to Surgeon-Lieutenant-Colonel Lawrie for further examination.
										—	—	—	—	—	—	On May 4th the red were normal; the white were of two kinds as described, some of the large variety being multinucleated.
										—	—	—	—	—	—	On the 8th there was an increase in white corpuscles, the small variety being more numerous; some of them contained only one nucleus.
										May 8th	103°0	17½	4,700,000	70,000	—	
										" 13th	103°0	18½	5,400,000	80,000	—	
										June 11th	103°0	21	5,600,000	80,000	—	On June 11th the blood was examined from time to time since the last note, but nothing abnormal was seen. The white cells were as described.
										July 1st	103°0	26	5,200,000	70,000	—	On July 1st the blood was as before. The dog was much fatter and healthier; there had been an increase of 8 lb. since May 4th.
										" 18th	103°0	26½	5,400,000	60,000	Rosettes and spherule	On the 18th three rosettes and one spheroidal body very faintly pigmented were found in one slide.
										" 19th	103°0	26½	—	—	—	On the 19th there was nothing abnormal.

A TABLE OF 22 CASES OF PARTIAL EXCISION OF THE SPLEEN PERFORMED ON DOGS, SHOWING THE CONDITION OF THE BLOOD, ETC., BEFORE AND AFTER OPERATION—Continued.

Case.	Date of operation.	Sex and condition.	Portion of spleen removed.	Before operation.						After operation.						Remarks.					
				Date.	Anal temp.	Weight in pounds.	Red.	White.	Abnormal.	Date.	Anal temp.	Weight in pounds.	Red.	White.	Abnormal.						
7	1896 May 6th	Healthy male	Lower half	1896 May 4th	102.6	24	5,240,000	40,000	—	—	—	—	—	—	—	On May 4th there was nothing abnormal; the white cells were as described.  Blood was examined, stained and unstained, on each of these dates; nothing abnormal was found. The white cells were as usual.					
				" 6th	103.0	24	5,100,000	40,000	—	—	—	—	—	—	—						
				May 10th	103.0	23½	5,200,000	50,000	—	—	—	—	—	—	—						
				" 16th	102.8	24	5,400,000	60,000	—	—	—	—	—	—	—						
				June 1st	103.0	25	5,150,000	60,000	—	—	—	—	—	—	—						
8	May 9th	Healthy female	Lower half	May 2nd	102.6	28½	5,200,000	37,000	—	—	—	—	—	—	—	On May 2nd the red cells were normal; the white were of two kinds as described, the large variety were more numerous. On the 3rd the blood was as above.  The red were normal. The white were as described, the small kind stained well and had from 2 to 10 nuclei; the large stained with a cloudy appearance and had only one nucleus which was of various shapes (round, horse-shoe, serpentine, &c.), large eosinophiles. On the 20th the red were normal. Some of the large variety of the white were multinucleated. On July 10th one rosette, underwent no change. On the 11th there was nothing abnormal. On the 16th two rosettes, underwent no change.  There was nothing abnormal.					
				" 3rd	102.4	29	4,900,000	30,000	—	—	—	—	—	—	—		—				
				" 9th	102.6	29	—	—	—	—	—	—	—	—	—		—				
				May 10th	102.6	28½	5,000,000	60,000	—	—	—	—	—	—	—		—				
				" 13th	102.4	28½	5,840,000	60,000	—	—	—	—	—	—	—		—				
				June 11th	102.2	29½	5,000,000	60,000	—	—	—	—	—	—	—		—				
				" 20th	102.4	29½	5,240,000	70,000	—	—	—	—	—	—	—		—				
				July 10th	102.2	30½	5,100,000	60,000	Rosette	—	—	—	—	—	—		—				
				" 11th	102.4	30½	4,800,000	60,000	—	—	—	—	—	—	—		—				
				" 16th	102.4	30½	5,300,000	50,000	Rosettes	—	—	—	—	—	—		—				
				" 17th	102.4	30½	5,400,000	50,000	—	—	—	—	—	—	—		—				
				" 19th	102.2	30½	5,160,000	40,000	—	—	—	—	—	—	—		—				
				" 21st	102.2	31	5,300,000	40,000	—	—	—	—	—	—	—		—				
				9	May 9th	Healthy female (resection of four inches of gut on Sept. 12th, 1895.—Vide THE LANCET, Oct. 30th, 1897)	Lower half	May 2nd	103.0	28	5,200,000	30,000	—	—	—		—	—	—	—	On May 2nd the red cells were normal; the white were of two kinds as described, the large mononucleated being more numerous.  On the 9th the blood was normal. The old line of resection of gut was indistinguishable from the rest but for one thin adhesion. The spleen was somewhat enlarged and slightly fibroid.  The red were normal. Some of the large white cells were multinucleated and some of the small mononucleated. On June 10th the red and white were as last described. There was one spheroidal body with no apparent nucleus and faintly pigmented. On the 11th spheroidal body as above was seen with large, coarsely granular white cell in contact; after some time the white cell moved away.
								" 4th	103.0	28	4,900,000	30,000	—	—	—		—	—	—	—	
" 9th	103.0	28	5,100,000					30,000	—	—	—	—	—	—	—	—					
May 11th	103.0	27½	5,000,000					50,000	—	—	—	—	—	—	—	—					
" 13th	103.0	27	5,640,000					40,000	—	—	—	—	—	—	—	—					
June 4th	102.6	28	4,900,000					60,000	—	—	—	—	—	—	—	—					
" 10th	102.4	28	5,000,000					50,000	Spherule	—	—	—	—	—	—	—					
" 11th	102.6	28	5,300,000					60,000	Spherule	—	—	—	—	—	—	—					

[illegible]





20	June 19th	Medium sized male	Upper half	June 19th	103 0	25	5,100,000	30,000		June 14th " 20th July 1st " 18th	103 0 103 0 102 8 103 0	37 38 38 38½	4,820,000 5,200,000 4,400,000 5,300,000	60,000 70,000 80,000 70,000	— — — —	The blood was normal; white as usual.
	June 19th			June 19th	103 0	25	5,100,000	30,000		—	—	—	—	—	—	On June 19th the blood was normal. On the 20th and 21st the dog was very quiet and refused food. The blood was normal.
21	June 25th	Very small female	Lower half	June 25th	102 4	11	3,980,000	50,000	—	June 28th July 10th July 22nd	102 6 102 8 102 6	11 13 14½	4,100,000 4,300,000 4,100,000	70,000 80,000 70,000	— — —	The blood was normal; there was a large proportion of white cells of which the large variety preponderated. The blood was normal. The two varieties of white cells were about equal in number.
22	July 1st	Healthy female	Lower half	July 1st	103 0	24	5,240,000	40,000	—	—	—	—	—	—	—	On July 1st the red were normal. The white were of two kinds, but many of the large coarsely granular variety had two or more nuclei and the small finely granular had only one nucleus. The blood was as in the last note, the two varieties being about equal in number.

and ate voraciously anything they were given. The three dogs which had the upper half excised suffered greatly and one died from shock. It is the removal of the upper half of the spleen which is in my opinion so full of danger, so prolific of shock and often hæmorrhage from some small vessel which has either been overlooked or else has retracted before the ligatures were tied. The removal of the upper half is more difficult than that of the lower half; many more vessels need ligaturing, including, in some cases, the branch from the phrenic previously mentioned and which may easily be overlooked with fatal results. This artery was present in two of the three excisions of the upper half and in three of my six total excisions. In man it is also occasionally present. Mr. G. A. Wright, of Manchester, and Surgeon-Major Hatch,<sup>5</sup> of Bombay, report cases where hæmorrhage from this vessel caused the death of their patients and Mr. Wright knows of three other similar cases. Again, in removal of the upper half greater tension has to be applied to the pedicle which is, I believe, a distinct cause of shock. Whether the whole spleen or only its upper half be excised does not affect the present argument. In the six cases of total extirpation before referred to all the dogs suffered greatly from shock and there were three deaths, the one already mentioned from marasmus and two from shock. If to these six be added the three in which the upper half was excised with one death we have nine cases and three deaths from shock, a mortality of 33·3 per cent., the survivors also suffering greatly as compared with the nineteen cases of excision of the lower half with no shock or death. May not this great difference be explained by a consideration of the nerve-supply of the spleen and of the relative damage done to the sympathetic nervous system in each case? for on these sympathetic nerves depends the normal tone of all the abdominal vessels and viscera containing any muscular tissue, and all changes in the calibre of these vessels—paralysis or inhibition of their vaso-constrictor fibres causing an extreme fall of blood-pressure, the animal practically bleeding to death into his abdominal vessels—and sudden death has resulted from a slight blow in the epigastric region or from a draught of iced water interfering with the functions of these nerves. It may be well to briefly consider the blood-supply of the spleen first, as the arteries are surrounded or accompanied by the nerves.

The splenic artery, by its pancreatic branches, supplies the body and tail of the pancreas; the left gastro-epiploic running along the greater curvature supplies both surfaces of the stomach and sends branches to the omentum on the left side, some of which may run on to supply the spleen; other branches to the stomach, the vasa brevia, four to eight in number, are given off towards the termination of the splenic artery, some of these arising directly from the trunk and some from the upper two or three of the terminal or splenic branches. The artery then divides some little distance from the spleen into a varying number, from five to ten, terminal or splenic branches which enter at the hilus and ramify in the body of the spleen; some of the upper of these, as we have seen, give off short gastric branches. In addition to the above there is often the branch from the phrenic running to and supplying the spleen.

The nerves which accompany these arteries are derived from the solar plexus. This, the largest sympathetic plexus in the body, is built up by the semilunar ganglia, nerves from the lumbar portion of the gangliated cord of the sympathetic, the great splanchnics, and the vagi. Through its secondary plexuses it supplies the diaphragm (in part) and all the viscera and blood-vessels of the abdomen. Of these secondary plexuses the celiac chiefly concerns the present argument. This plexus is of large size, derived from the fore-part of the solar plexus, is joined by the two small splanchnics, and on the left side is augmented by large, direct branches from the right vagus. It then furnishes the coronary, hepatic, and splenic plexuses; the latter, surrounding the splenic artery, is again joined by direct branches from the left semilunar ganglion and the right vagus. It supplies the pancreas and stomach through its pancreatic and left gastro-epiploic plexuses, some of the latter running on to the spleen; it again supplies the stomach by branches accompanying the arterial vasa brevia and then running with the terminal branches of the artery ends in the spleen. In addition to these nerves there are branches from the diaphragmatic plexus accompanying the branch from the phrenic artery when this is present. During an operation it

<sup>5</sup> Quoted by Jacobson in his *Operations of Surgery*, second edition, pp. 840, 841.



is impossible, of course, to separate these nerves from the arteries, so that a ligature necessarily includes both. A comparison of the operations may be thus stated: (a) Removal of the whole spleen necessitates the ligaturing of—1. The splenic branches or, what is the same thing in effect, the splenic artery and nerves before they divide into their terminal branches. 2. The vasa brevia arising from the terminal or splenic branches. This must be done even if the trunk of the splenic artery itself be divided or else, with the free anastomoses that exist on the stomach, there will be hæmorrhage backwards along these branches; neglect to ligature these arteries is probably the cause of some of the deaths from hæmorrhage after the extirpation of the organ. 3. The branches from the left gastro-epiploic and phrenic when present. If these have been divided close to the spleen as many as from fifteen to twenty small vessels and their accompanying nerves may be included in the different ligatures on the pedicle. If the splenic artery itself be divided this number would be reduced by the five to ten terminal branches, but the effect on the nervous system would be the same, the "trunk" of the nerve being involved in place of its branches. (b) Removal of the upper half necessitates the ligaturing of the same arteries except the lower two or three terminal branches, as many as from twelve to eighteen vessels and nerves being included in the ligatures on the pedicle. (c) Removal of the lower half can be effected by ligaturing the lower two or three terminal branches only. In the two latter operations there is in addition the continuous ligature across the spleen.

From this it will be seen that excision of either the whole or the upper half of the spleen involves great damage to the splenic plexus with its intimate—threefold, if I may so call it—connexion with the solar plexus and right vagus; entails direct interference with part of the nerve-supply of the stomach and omentum and severe indirect interference with the vagi and all the sympathetic nerve-supply of the abdomen; the diaphragmatic plexus is often involved and considerable tension has to be applied to the pedicle, and therefore on the coeliac and solar plexus and the vagi, thus augmenting the interference with these nerves. The excision of the lower half entails but slight damage to the splenic plexus and therefore but slight indirect interference with the solar plexus and vagi; the nerve-supply to the stomach, the omentum, and the diaphragmatic plexus is never involved and but slight tension has to be applied to the pedicle. As shock is due to severe inhibition and exhaustion of nerve function<sup>6</sup> and the grosser the lesion the greater is the shock that results, this great difference in the amount of interference with the nervous system in these operations is the explanation, I believe, of the great difference in the amount of shock following them; and in the excision of the whole spleen or of the upper half the resultant shock is due to inhibition and exhaustion of the vaso-constrictor fibres of the abdominal sympathetic and is probably intensified by great interference with the proper performance of the functions of the heart, lungs, stomach, &c., reflexly by means of the vagi. These considerations would induce me to advise in suitable cases in the human being—e.g., abscess, tumour, or cystic disease confined to the lower half or in hypertrophy which resists medicinal treatment—the excision of the lower half in preference to that of the whole spleen, as the same object would be attained—the removal of the disease or the enlargement—whilst a considerable portion of the spleen would be left to carry on its function, and further, there would be as a reasonable inference a considerable reduction in the death-rate.

It will be noticed that immediately after the operation there was as a rule a slight loss of weight; this was quickly recovered, and all the dogs, except Case 10, gained weight subsequently, the least gain being  $\frac{1}{2}$  lb. and the greatest  $8\frac{1}{2}$  lb. This increase in weight was in the majority of cases undoubtedly due to regular and liberal feeding which in their previous homeless lives the dogs had been unaccustomed to, but in Cases 11, 12, 15, and 21 in which the gain in weight was greatest the dogs were small and probably not full grown at the time of operation, so that part of the increase was most likely due to the normal growth of the dogs. The temperature (rectal) of these dogs was most constant; in nine of the twenty-one survivors it never varied from  $103^{\circ}$  F.; in three it never quite reached  $103^{\circ}$ , ranging from  $102^{\circ}2'$  (Case 8) to  $102^{\circ}8'$  (Case 21); in eight the highest was  $103^{\circ}$  and the lowest  $102^{\circ}4'$  (Cases 9 and 12); in the other (Case 10) on one

occasion it reached  $103^{\circ}5'$ . The greatest individual range of temperature, except Case 10, was  $0^{\circ}6'$ . All these cases were operated upon with a daily atmosphere temperature of from  $99^{\circ}$  to  $104^{\circ}$  in the shade. Case 10 stands by itself; it had been accustomed to regular feeding prior to operation, having been a house-dog; it was the only one in which the temperature exceeded  $103^{\circ}$ , in which there was loss of weight and a marked or permanent alteration in the number of red corpuscles and the only one in which filaria were found in the blood, which probably is the explanation of all these differences. Two of the dogs were subsequently killed by an overdose of chloroform; the spleen had assumed a flattened globular shape and had increased slightly in size since the excision of the other part, but had not attained its original size. The capsule at the site of section showed signs of old inflammation and the omentum was adherent at this point. In one case the continuous ligature was found encapsuled, in the other it had been absorbed.

*The blood.*—The examinations of the blood and the enumeration<sup>7</sup> of the corpuscles were most interesting. The first five cases are excluded from the following remarks as the number of corpuscles could not be ascertained before operation, and the subsequent enumerations in Cases 1 and 2 showed only a steady increase in number of the red and white coincidently with the growth of the pups; Case 3 showed no marked change and Case 5 will be referred to later. Before operation the number of red corpuscles varied from 3,500,000 in Case 12 to 6,000,000 in Case 16, the average being 4,920,000 per c.mm. If Cases 11, 12, and 21 be excluded, for reasons to be shortly stated, the average would be 5,170,000 per c.mm. The white varied from 30,000 in several cases to 60,000 in Case 6, the average being 41,000 per c.mm.; the proportion of white to red being 1 to 120. After operation in the majority of cases there was no marked change in the number of red corpuscles; excluding Case 10 they averaged 4,900,000 per c.mm., as against 4,920,000 before operation; excluding Cases 11, 12, and 21 the average would be 5,100,000 per c.mm. as against 5,170,000 before operation. This small difference might well be due to errors of observations before or after operation, any one of which would necessarily be multiplied 10,000 times. The white corpuscles showed an immediate increase in number after operation, the smallest increase being 20,000, the greatest 40,000, and the average 30,000 per c.mm., the ratio of white to red being altered to from 1 to 70. This increase reached its maximum soon after the operation, began to diminish a fortnight to six weeks after, and in those cases that were under observation two months after operation the number of white and the proportion of white to red was normal again. This temporary increase was probably due to the irritation of the continuous ligature and the localised inflammation of the spleen and its capsule at the site of section. The Cases 11, 12, and 21 were small dogs which increased considerably in weight after operation; the red cells also increased in number and from a comparison of these cases with the pups (Cases 1 and 2) it is probable that they were not mature at the time the operation was performed and that the increase in weight and in the number of the red cells was consequent to the growth of the dogs.

In the ordinary microscopic examination, stained and unstained—and the following remarks apply to all twenty-one surviving cases—the red cells were normal, in a few cases they were vacuolated, and in Case 10 pale and deficient in hæmoglobin. The white were apparently of two kinds, small and large. The small variety was circular, usually finely granular, with two or more nuclei, but often contained only one nucleus and at times were coarsely granular; they were never seen to change shape. The large variety was usually coarsely granular with one nucleus, the latter being of various shapes, semilunar, round, serpentine, &c., often giving to the cell the appearance of being multinucleated; occasionally these large cells were multinucleated and rarely finely granular; they exhibited free amœboid movement. Sometimes the large and at other times the small variety was more numerous. Although these two kinds were the usual white cells seen at times other forms were found, intermediate in size, sometimes mononucleated, at others multinucleated, sometimes coarsely, at others finely granular and rarely having both fine and coarse granules in the same cell. The impression was thus given that the large and small varieties were only stages in the life of the same cell. In Case 5 there were seen occasionally very large

<sup>6</sup> Foster's Text-book of Physiology, fifth edition, Part III., p. 903.

<sup>7</sup> By Gowers's hæmacytometer.

multinucleated white cells with a diameter two or three times that of the ordinary large variety mentioned above; they exhibited free amoeboid movement, had coarse and fine granules in the same cell and often large vacuoles. One of the most interesting points in the blood examinations was the appearance, in Cases 5, 6, 8, and 9, of bodies which were extremely like those Laveran discovered in malarial blood. So great indeed was the similitude that had these bodies been seen in the blood of a patient suffering from malarial fever I have no hesitation in stating that they would have been pointed out as fairly typical specimens of the "rosette" and spherical extra-corpuscular, or free stages, of the parasites. I hope in another paper to describe these bodies more fully. An interesting bloodworm was seen in Case 10 and watched for three-quarters of an hour. It was round in shape and in breadth nearly but not quite the diameter of a red cell. It was impossible to define its length on account of the free movements when alive and to its being coiled up when dead, but when nearly straight it reached across the field (Leitz eyepiece 3, objective 7), one or other end being out of sight. Its body was cylindrical, tapering rapidly near the tail. Its head was slightly smaller in diameter than the body and blunt-ended with a transverse "depression" rather nearer the under than the upper surface. When first seen the worm was gently waving its body in exactly the same way as an eel does when swimming; at short intervals it was seen to retract its head and then rapidly shoot it out. By careful watching it was seen that a red corpuscle was the object aimed at and that as the head shot forward a triangular-shaped "tongue" was protruded from the depression; this was at once withdrawn when the corpuscle was struck and after the first or second attack a minute, darkish speck was seen to leave the corpuscles at each attack and flow into the depression or "mouth" of the worm; after a few attacks the corpuscle was paler than before. Many red corpuscles were in turn attacked and once a large white cell was attacked in the same way, but after two or three blows the worm moved on and to follow it the field had to be changed and so the white cell was lost; when first attacked this cell was moving and my impression was that its movement ceased with the attack, but too short a time was allowed to be sure of this. In about half an hour the worm gradually ceased to attack the red cells and its movements became much more vigorous, swimming about so rapidly that it was difficult to change the field quickly enough to keep the worm in sight. Occasionally at this stage it coiled itself up like a watch-spring and suddenly straightened itself out, dashing the red cells about in all directions; these convulsive or lashing movements became more and more frequent until there was hardly any intermission. The worm then appeared to grow weaker, its movements became less in number and vigour, and at last it lay still, coiled up in two and a half convolutions. As this change of movement was taking place the blood was seen to be coagulating, this probably causing the death of the worm, which then appeared to be faintly striated both longitudinally and circularly.

In conclusion I desire to express my grateful acknowledgements to the medical department of H.H. the Nizam's Government and to Surgeon-Lieutenant-Colonel Lawrie, the residency surgeon and principal of the medical school, for the kindness and courtesy they extended to me during my residence in Hyderabad and for the facilities and resources they so willingly placed at my disposal for these and other investigations. My thanks are also due to Dr. Nelly Evans, Dr. Kalayan Rao, and Dr. Syed Mohammed for their assistance in the blood examinations. Dr. Evans also performed successfully several partial excisions of the spleen by the operation described.

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ROYAL METEOROLOGICAL SOCIETY.—The annual meeting of this society was held on Wednesday, the 19th inst., at the Institution of Civil Engineers, Mr. E. Mawley, F.R.H.S., president, being in the chair. The secretary read the report of the Council for the year 1897, showing that there had been an increase in the number of Fellows and that the finances were satisfactory.—Mr. F. C. Bayard, LL.M., was elected president for the year.—The President then gave an address on "Weather Influences on Farm and Garden Crops."

## ON A CASE OF SUPPOSED TRANSMISSION OF SYPHILIS TO THE THIRD GENERATION.

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THE possibility of the transmission of syphilis to the third generation—i.e., from grandparent to grandchildren—is a question of great theoretical interest rather than one of frequent practical importance. Even at the present day the possibility of such transmission rests on no sure or settled basis. Relying on the more than dubious interpretation of certain Biblical texts the lay public have for long accepted and believed in the undoubted and frequent occurrence of such a transmission. Needless to say this aspect of the question is without the pale of scientific scrutiny. Like the laity, a large majority of the profession would seem to have accepted the reality of this transmission. But to me it would appear that in this instance they have been more ready in declaring their belief than in adducing reasons or facts in substantiation of it. A small minority of the profession—including, however, I believe, a large percentage of those who have given special attention to the subject—have gravely doubted the possibility of this transmission to grandchildren, or at least have denied the publication of a single case of such as would bear the investigation of a stricter criticism. Dr. George Ogilvie has lately published an excellent and elaborate paper<sup>1</sup> in which he has carefully and trenchantly criticised every notable case where this transmission has been stated to have occurred. With all that Dr. Ogilvie writes concerning such cases I heartily agree—in fact, with possibly the exception of one published by Boeke<sup>2</sup> no single one of these cases will stand even the most superficial criticism. Boeke's case, moreover, is far from convincing. Recognising the futility of proving the presence of unmistakable syphilis in such cases, and being seemingly still desirous of tracing in the grandchildren some syphilitic heritage from the grandparents, certain writers have claimed a syphilitic origin for numerous maladies in such grandchildren which they have classed under the title of "parasyphilitic." These parasyphilitic maladies, too, they claim, are largely prevalent in the later children of syphilitic parents where the elder children have directly inherited the undoubted complaint. There is not one, however, of such so-called "parasyphilitic" complaints that may not occur in children in families where syphilis can with certainty be excluded. I would then strongly protest against the use of "parasyphilitic" and other like terms. The ills of syphilis are numerous and far-reaching enough without any extra fanciful additions being credited to them. If the case of the transmission of syphilis to the third generation has to rest on the presence of "parasyphilis" in the grandchildren then the proof of such transmission, I would claim, falls to the ground.<sup>3</sup>

The following is a fair example of the class of cases that have been put forward as a proof of the transmission of syphilis from grandparents to grandchildren. In my opinion it is entirely unconvincing on this point. It may perhaps merit publication on other grounds as an example of the singular and unsatisfactory class of progeny that may unaccountably be raised by reputedly healthy parents and of the curious coincidence of two first cousins exhibiting the first symptoms of syphilis in precisely the same form and situation, both of these last being an extremely unusual one. The particulars were furnished me by a distinguished member of the profession who has held high office at the Royal College of Surgeons of England. For reasons that are perfectly intelligible and sufficient he prefers not to publish the case himself, although he will allow me to furnish his name to anyone desiring any further information on the case. That I would controvert his own interpretation of the facts is also known to him and I do so freely with his stated permission.

A man of powerful physique lived to a good old age

<sup>1</sup> The British Journal of Dermatology, October, and November, 1897.

<sup>2</sup> Annales de Dermatologie et Syphiligraphie, tome x., 1889, pp. 782-784.

<sup>3</sup> See note on pp. 28-29 in paper by George Ogilvie before referred to.