ON THE BREAKING UP OF FAT IN THE ALIMENTARY CANAL UNDER NORMAL CIRCUMSTANCES AND IN THE ABSENCE OF THE PANCREAS.*

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In a previous paper¹ I discussed the simple absorption of milk fat from the alimentary canal of dogs, and compared the results with a series of dogs in which the pancreas had been previously removed. Fasting dogs fed on milk absorbed no less than 21 to 46 per cent. of the total fat given in seven hours, while in those where the pancreas had been entirely removed some two days previously, there was, during that space of time, no evidence of any absorption whatever from the alimentary canal.

The fact that no marked absorption of fat occurred in dogs after the extirpation of the pancreas seems to confirm the old view that the pancreatic secretion was necessary for absorption.

This alleged action of pancreatic juice in preparing fat for its absorption from the alimentary canal is usually supposed to be due to the secretion containing, first, a fat-splitting ferment, which, by breaking up part of the neutral fat into free fat acids and glycerine, leads to the first stage of emulsification; and, secondly, alkaline sodium carbonate, which combines with some of the freed fat acids to form a soap, and thus rendering the emulsification of the fat—a simple matter, as can easily be demonstrated in a test tube—and at once facilitates its absorption through the intestinal walls.

The manner in which altered or emulsified fat may traverse the intestinal or mucous membrane is not discussed in the present paper, but only the manner and degree of breaking up of ingested milk fat, and the part played in such a process by the pancreas. My former paper showed that there was a great decrease in the absorption of fat when the pancreas was removed, and it is my present purpose to show how much of this is due to the absence of either the fat-splitting ferment or of the alkaline sodium carbonate of the pancreatic secretion.

For the purpose of comparison, the average results of the experiments may be tabulated in the following way, so that the normal results may be compared with those in which the pancreas had been previously removed.

Comparison of the Percentage Composition of the Fats in the different parts of the Alimentary Canal on a Milk Diet, of Normal Dogs (A) with those in which the Pancreas (B) had been previously Removed.

	Neutral Fat.		Free Fat Acids.		Fat Acids as Soap.	
	Normal. A.	Pancreas B.	Normal. A.	Pancreas B.	Normal. A.	Pancreas B.
Stomach ...	77.54	68.1	18.50	31.29	0.63	0.55
Small intestine	24.67	22.50	72.22	61.62	3.14	5.79
Large intestine	34.17	33.27	58.65	53.32	7.19	13.41

It is not necessary here to again draw attention to the extracts from the literature of this complicated subject, which I quoted in the previous paper, and which showed that there was reason to believe that neutral fat not only could be split up into fat acids and glycerine in the absence of pancreatic secretion, but even form soaps. The present research has for its object the precise determination of this point.

The results obtained may therefore be divided into normal and pathological, that is, according to whether the pancreatic secretion is present or absent. Thus:

Extracts from a paper read at the Royal Society.

1. The normal splitting up of fat in the various parts of the alimentary canal in dogs on a milk diet.

2. The effect of removal of the pancreas on the splitting up of fat in dogs on a milk diet.

When we compare the results found in normal dogs during the absorption of milk fat with that in the dogs in which the pancreas has been removed, there is not such a great difference as one would be led to expect from the old teaching of the fat-splitting action of the pancreas.

The average number of cases in the above table is three in each column, except in that of the large intestine of the normal dogs, in which the results of only two experiments were used, and the period of digestion was seven hours, except in one case of removal of the pancreas, in which it was only six hours.

As far as the stomach is concerned, the table shows that there is a slight increase in the quantity of fat acids in dogs in which the pancreas has been removed, as the percentage noted was 31.29 per cent. of the total fat, while in normal dogs which were employed as control only 18.50 per cent. of the total fat was present in the form of free fat acids. This would be in favour of a greater fat splitting up activity of the stomach in dogs in which the pancreas had previously been removed. That a greater splitting up action was really the cause of this increase is difficult to believe. It would seem much more likely that the increased percentage of fat acid in the dogs without the pancreas was due to the greater retention of fat in the stomach, for in all cases in which the pancreas had been removed, the expulsion of fat from the stomach was very much delayed.

The percentage quantity of fat acids present as soap in both the normal and the pathological dogs is practically equal, for in both cases no less than 0.63 and 0.55 per cent. of the free fat acids were present as soap in the stomach.

The table therefore proves that both in normal dogs as well as in those in which the pancreas has been removed, the stomach is capable of not only splitting up neutral fat into free fat acids and glycerine; but, further, that the free fat acids are capable of finding alkalis in the stomach itself wherewith to form soaps. The power of the free fat acids to form soap is, however, extremely limited in the stomach.

The principal fat-splitting action really begins, not in the stomach, but after it has left the pylorus. That this should be the case in normal dogs has long been held by all physiologists, and was considered due to the action of the pancreas, and the degree to which this occurs is shown in the table, according to which in the normal dog at least 72.22 per cent. of the fat present in the small intestine was in the form of free fat acids, only 24.67 per cent. being present as neutral fat. But also in the case where the pancreas had been entirely extirpated, so that no pancreatic juice could possibly reach the intestine, and the fasting had been sufficiently long to remove any pancreatic ferments which might have been previously present in the intestines, we still find a large increase in the quantity of the fat acids present, the fat acids being no less than 61.62 per cent. of the total fat. There can be no doubt, therefore, that even when no pancreatic secretion has reached the intestines, a very considerable quantity of the neutral fat is split up into free fat acids in the small intestine, although the quantity there formed is not so great as when the pancreatic secretion has been able to add its share of work.

The free fat acids combined with soaps in the normal dog was only 3.14 per cent. of the total fat present, while those dogs in which the pancreas had previously been removed had no less than 5.79 per cent.

This is a most interesting fact, for in spite of the absence of the alkaline pancreatic secretion, it is found that not only nearly the normal quantity of free fat acids are present, but a considerable increase of fat acids have formed soaps, so that the intestines have been able to secrete a sufficiency of alkali substances to form soaps.

The contents of the large intestine of the second group of cases resemble each other far more closely. In fact, in the case of the free fat acids, the quantity present in both the normal control dogs and those in which the pancreas had previously been removed is, for all practical purposes, equal, the control dogs having 58.65 per cent. of fat, in the form of free fat acid, while those dogs in which no pancreatic secre

tion had reached the intestines, 53.32 per cent. The effect of the want of pancreatic secretion, although exhibited to a small extent in the small intestine, and causing a diminution in the quantity of fat acids present, was no longer apparent in the large intestine.

The quantity of fat acids present as soaps in the large intestine vary, although not to a greater extent than was the case in the small intestine. Those dogs in which the pancreas had been previously removed contained 13.41 per cent. of the total fat in the form of fat acids combined as soaps, while 7.19 per cent. only was in this form in those dogs which were used as control experiments.

REFERENCE.

¹ *Journal of Physiology*, vol. xviii, p. 1, 1895.

MEMORANDA:

MEDICAL, SURGICAL, OBSTETRICAL, THERAPEUTICAL, PATHOLOGICAL, ETC.

DYSTOCIA DUE TO HYDROCEPHALUS IN A PRIMIPARA.

On January 3rd I was asked to attend the wife of a farm servant residing about 6 miles from here. The message was urgent, as the patient was said to be bleeding badly. I found the woman blanched and exhausted, and the pulse rapid and feeble. She was lying in bed in a pool of blood and "waters." She was in the beginning of the ninth month of pregnancy. She had risen at 7 A.M., and while dressing had been seized with severe hæmorrhage. She was assisted back to bed again, and in a few minutes the bleeding all but ceased. About 9 A.M. she began to complain of pains, and this was followed by a recurrence of alarming hæmorrhage. From that time till my arrival about 11 A.M. she was having periodic pains, during which the bleeding lessened. I found that the membranes had ruptured, the os was dilated to about the size of a crown piece, and through it protruded the left hand and forearm. The woman being a primipara, and very nervous and excited, I judged it best to give her a little chloroform, and then introducing the whole of my right hand *per vaginam*, I gently attempted to replace the arm, and get rid of the transverse position. Owing to the absence of liquor amnii, and the half-dilated condition of the os uteri, the task was difficult, but by gradually dilating the os with the fingers I was at last able to reach a foot, and bring it down into the vagina. Thereafter for a time all went well, though the feeble condition of the woman was a source of anxiety. Slowly the hips and part of body were born, but both arms were "up," and gave considerable trouble to bring down, and the head remained fixed and defied all efforts at removal.

The position was now occipito-anterior. Though the child had never shown any signs of life, I did not want to perforate the base of the skull. Passing three fingers of the left hand beyond the chin of the child, placing the middle finger in the mouth, and the other two on both sides of the nose, the right hand and arm swinging the body of the child well up between the woman's thighs, I made as great traction as I dared, and slowly the head commenced to slip, and at last delivery was complete, and my difficulty was explained when an enormous hydrocephalic child lay on the bed.

The woman made an excellent recovery, and is now quite well and strong.

Brechin.

HECTOR M. ROBERTSON, M.B., C.M.

CURIOUS COURSE OF A BULLET.

[Communicated by the DIRECTOR-GENERAL R.N.]

A MUSSULMAN, aged 60, came under my care at Sitia, Crete, for a bullet wound of the chest. The bullet, which was from a Gras rifle, caused first a comminuted fracture of the left thumb, which was in contact with the chest wall at the time; it then entered the chest wall 2 inches above and 2 inches to the inner side of the left nipple, passed upwards and outwards along the rib, was deflected downwards by the anterior surface of the left scapula, and continued on this course until it reached the crest of the left ilium; it then passed nearly vertically upwards to the wound of exit which was situated

about 1½ inch below and in a line with the inferior angle of the left scapula. The pleura was wounded *en route*. After leaving the body of this patient it tore a large piece from the pectoral muscles of a child aged 5, who was probably clinging to the old man from behind. There were no signs of any injury to the lung itself, and the case did well.

The vitality of the Mussulman Cretans is remarkable; a man at Spinalonga had been transfixed by a bayonet at the level of the seventh rib, right side, and also received a bullet clean through the neck from one sterno-mastoid to the other; in three weeks he was well, having had no surgical treatment beyond a first dressing.

H. F. D. STEPHENS, M.B.,
Staff-Surgeon R.N.

H.M.S. *Nymphæ*.

POISONING BY LINIMENTUM BELLADONNÆ.

A LADY, aged 53, on the night of March 10th measured into a medicine glass 1 tablespoonful of the linimentum belladonnæ in mistake for a bromide mixture, which she had occasionally taken. She discovered her error after swallowing it, but not knowing the dangerous character of the preparation, retired to bed.

At 1.30 A.M. of the 11th she awoke a visitor who slept in the opposite room, complaining of dryness of the lips, mouth, and throat with great thirst and giddiness. The visitor realising that the patient was suffering from poisoning sent off a mounted messenger for me, and immediately gave her a dose of table salt and water, which had the desired effect of producing vomiting.

I saw the patient at 3 A.M.; she was in bed; she evidently recognised me, and made an attempt to greet me. I found the pupils largely dilated, the utterance impaired, with gay delirium; incessantly talking; chiefly occupied with the meet of the foxhounds in the neighbourhood the next day; pulse somewhat accelerated, and the skin warm.

I immediately injected half a grain of pilocarpin, and with a lavage apparatus washed out the stomach with hot coffee and brandy added. I stayed with her until 6 A.M., when she appeared much improved, but the chattering still continued. When I saw her again at 10.30 A.M. she much better, and in the evening determined to get up for an hour. She still complained of the inside of her chest feeling hot and burning and inability to walk straight, and suggested that the poison had got into her nerves. She imagined that her fingers and hands looked yellow.

I saw her the following day. She was able to walk slowly in the garden, but evidently was still very shaky. There was no rash, nor either involuntary discharge nor suppression of urine.

REMARKS.—I think it desirable to place the case on record inasmuch as the portion of the drug taken was a known quantity, and to point out that, owing to the careless dispensing of half a pint of this powerful liniment by a firm of chemists in a neighbouring town in an ordinary half-pint medicine bottle, a valuable life was for a time placed in jeopardy.

Barnsley.

J. FLETCHER HORNE, M.D., F.R.S.Ed.

REPORTS

ON

MEDICAL & SURGICAL PRACTICE IN THE HOSPITALS
AND ASYLUMS OF GREAT BRITAIN, IRELAND,
AND THE COLONIES.

FULHAM UNION INFIRMARY.

A CASE OF ACUTE INTESTINAL OBSTRUCTION.

(By W. DENISON WIGGINS, M.R.C.S., L.R.C.P.)

The following case is remarkable for the cause of the above condition:

M. P., a woman aged 38, married 22 years, no children, was admitted on February 23rd, 1897. She had been ill since February 9th, complaining of pain, severe at times, and of a bearing-down character, in the hypogastric region. During the succeeding days she became constipated, and on February 19th took some aperient medicine, which resulted in an