suggested that the appearance of this retinal embolism supported the theory which held chorea to be of embolic origin. Langdon (1925) concluded also that his case was due to embolism.

It is noteworthy that out of five cases of retinal arterial obstruction where the state of the heart was reported (Swanzy, 1875; Knapp, 1918; Langdon, 1925; Milnes Bride, 1937) two—those of Swanzy and Milnes Bride—were said to show no evidence of endocarditis. Our case falls into the latter group.

The theory that chorea was due to multiple emboli never enjoyed complete acceptance and now has no support. Greenfield and Wolfsohn (1922) quoted 15 references from the earlier literature noting Kirkes and Houghlings Jackson as expounding the "embolic theory" of chorea and Bastian as offering a "thrombotic theory," "the corpora striata and adjacent parts being the seat of a subacute inflammation characterized in part by the production of multiple minute thromboses." Other authors were quoted as reporting changes principally in the architecture and staining properties of the neurones. There was so much variety from case to case in the pathological changes observed by the authors quoted by them that Greenfield and Wolfsohn "concluded from a study of the above that there was still much to be written about the pathology of the disease." They described a necropsy study of their own on a female patient aged 7 years who died of acute chorea and in whom vegetations were found on the mitral and aortic valves. Vascular changes were present everywhere in the brain. Many of the cortical vessels had undergone thrombosis and some of the smaller vessels showed plugging by clumps of leucocytes. Many of the capillaries showed proliferation of their endothelial lining, and outside these there were in many places chains of small round cells.

They concluded that if emboli did occur in chorea these could not be the cause of symptoms since (1) chorea did not occur in ulcerative endocarditis, nor did the symptoms of cerebral embolism correspond to chorea; (2) many cases of chorea occurred where there was no disease of the heart valves and therefore no source for the hypothetical emboli; and (3) it seemed impossible to believe that the symptoms produced by an embolism would have yielded so rapidly to treatment as those of acute chorea frequently did.

Subsequent histological studies have been few. We have traced two cases reported by Buchanan, Walker, and Case (1942), one by Bauer, Riley, and Cohen (1950), one by Colony and Malmud (1956), and two reported by Maurice Lessof (1958).

These scattered, more recent reports confirm the findings of Greenfield and Wolfsohn (1922) that there is no pathology common to all cases of chorea. The arguments against an embolic pathology advanced by them still appear relevant, but these arguments would not be valid when applied to a concurrent retinal arterial occlusion. In fact, the occurrence of a fibrin embolus seems a possible explanation for this event, although this explanation would be more acceptable in those cases where acute rheumatic endocarditis had been detected. However, there is evidence that widespread vascular changes occur in the brain in some cases of chorea, appearing as thromboses or endothelial proliferation. It is felt that these phenomena cannot be excluded as causes of the retinal arterial occlusion in the case here reported.

Summary

A case of retinal arterial obstruction is reported in which chorea was subsequently observed.

Twelve other cases of retinal arterial occlusion in association with chorea have been traced in the literature.

Possible causes for this disorder are discussed.

REFERENCES

- Bauer, F. K., Riley, W. C., and Cohen, E. B. (1950). *Ann. intern. Med.*, **33**, 1042.
 Bride, T. M. (1937). *Trans. ophthalm. Soc. U.K.*, **57**, 346.
 Buchanan, D. N., Walker, A. E., and Case, T. J. (1942). *J. Pediat.*, **20**, 555.
 Coats, G. (1914). *Ophthalm. Hosp. Rep.*, **19**, 45.
 Colony, H. S., and Malamud, N. (1956). *Neurology*, **6**, 672.
 Greenfield, J. G., and Wolfsohn, J. M. (1922). *Lancet*, **2**, 603.
 Harms, C. (1914). *Arch. Ophthalm.*, **87**, 334.
 Knapp, A. (1918). *Arch. Ophthalm. (N.Y.)*, **47**, 459.
 Langdon, H. M. (1925). *Amer. J. Ophthalm.*, **8**, 626.
 Lessof, M. (1958). *Guy's Hosp. Rep.*, **107**, 185.
 Swanzy, H. R. (1875). Quoted by Langdon (1925).
 Thomas, H. (1901). *Johns Hopk. Hosp. Bull.*, **12**, 321.

Medical Memoranda

Protein-secreting Tumour of Stomach: Severe Hypoproteinaemia Cured by Removal of Gastric Polyp

Severe hypoproteinaemia is always a sign of disease, in some cases due to easily recognized external loss of protein (nephrosis, burns, bleeding), in others to a reduced production (liver diseases and chronic infections) or increased internal breakdown of albumin (fever, A.C.T.H. therapy).

Recent investigations have shown that idiopathic hypoproteinaemia, too, is not a disease *sui generis*. In all the studied cases the hypoproteinaemia was due to loss of protein (primarily albumin) into the lumen of the gastro-intestinal tract (Gordon, 1959; Schwartz and Jarnum, 1959; Young *et al.*, 1959; Gross *et al.*, 1960; Jarnum and Petersen, 1961). Here the proteins are digested by the enzymes, and, as the liver is unable to increase its albumin production sufficiently, hypoproteinaemia results. This so-called "protein-losing gastro-enteropathy" (*Lancet*, 1959) has proved to be associated with different diseases: hypertrophic gastritis, gastric carcinoma, granulomatous diseases of the small intestine and mesentery, and regional enteritis. The loss of protein can even take place through a small intestine without any striking gross or microscopical changes.

A case of excessive hypoproteinaemia caused by gastro-intestinal loss of protein from a gastric tumour is here reported.

CASE HISTORY

A 73-year-old man was admitted to the neurological department, Copenhagen County Hospital, Glostrup, because of a suspicion of brain tumour. He had had no serious illnesses previously, but two years before admission oedema of feet and legs started, gradually spreading upwards. The oedema had not caused any great discomfort. He had eaten ordinary food and had not had any gastro-intestinal complaints whatsoever. Marked exacerbation of the leg oedema, enlargement of his girth, and dizziness and

headache followed influenza A 18 months before admission. As a neurological examination failed to reveal any abnormality, he was transferred to medical department F.

Physical examination showed severe oedema of the legs, abdomen, and back as far as the scapulae, severe ascites, and right-sided hydrothorax.

Laboratory Findings.—Hb, 10.1 g./100 ml.; red cells, 3,050,000/c.mm.; weight, 63.1 kg.; E.S.R., 6 and 3 mm./hr. Faeces: negative benzidine reaction. Thymol test, zinc sulphate, alkaline phosphatase, serum cholesterol, and serum creatinine were normal. Urine: no albumin. Serum protein, 3.1 g./100 ml.; serum albumin, 1 g./100 ml. Fasting gastric juice: + free acid and + free albumin on electrophoresis.

FIG. 1.—Radiograph of stomach, showing a gastric tumour.

X-ray Studies.—Chest: right-sided hydrothorax and atelectasis of the right lower lobe. Stomach: a tumour in the middle part of the stomach (see Fig. 1), presumably situated on the posterior wall of the body of the stomach. Fundus and pyloric region normal. Duodenum and small intestine: no abnormality.

The albumin turnover was studied by ^{125}I albumin, using the method of Pearson *et al.* (1958). The degradation constant was distinctly increased for circulating albumin (19.8% as compared with the normal range of 5.6–14.4%). The faecal excretion of ^{125}I activity was followed for five days, during which it was greatly increased (Schwartz and Jarnum, 1961). Later, a ^{125}I -polyvinylpyrrolidone test was carried out. This also showed an abnormally high faecal excretion (see Table).

The severe and otherwise unexplained hypoproteinaemia combined with definite evidence of a considerable gastro-intestinal loss of protein directly indicated the gastric tumour as the site of the leakage. There were no signs of inoperability.

Total Serum Protein, Serum Albumin, and Gastro-intestinal Protein Loss Before and After Removal of Protein-secreting Gastric Tumour

	Before Operation	After Operation	Normal
Total serum proteins (g./100 ml.)	3.1	7.3	5.9–8.1
Serum albumin (g./100 ml.)	1.0	4.7	3.8–5.1
Faecal loss of activity in 5 days after ^{125}I albumin	1.7%	—	0.0–0.39%
Faecal loss of activity in 5 days after ^{125}I -P.V.P.	3.3%	0.16%	0.03–1.01%

After several transfusions of plasma, albumin, and blood—during which the patient lost 13 kg.—the plasma proteins and haemoglobin returned to normal and laparotomy was performed.

The liver and intestines were normal. There was no ascites. Since, furthermore, there were no gross signs of nodal involvement and the tumour was well defined, subtotal gastric resection by the Hofmeister method was carried out. The removed tumour (Fig. 2) was irregular in shape, polypous, well defined from the gastric wall, and had a wide base with raised edges. Its size was 5.5 by 3 by 2.5 cm. The cut surface was greyish, firm, and elastic.

Microscopical Examination (Fig. 3).—The larger part of the polypous tumour consisted of very densely arranged glands lined with simple columnar epithelium. There was moderate infiltration with granulocytes, plasma cells, and lymphocytes. In some places glandular tissue infiltrated the muscles, and in several sites there were dilated lymph spaces with solid clusters of dedifferentiated glandular epithelium. Diagnosis: mucous polyp of the stomach (adenoma) with patches of carcinomatous development (E. Bredahl).

Radioactivity Study of Tumour Tissue and Gastric Tissue.—During the operation ^{125}I albumin was injected intravenously. From the removed operative specimen tissues were at once obtained for measurement of radioactivity in the tumour and in the normal mucosa of the body of the stomach. The activity in the tissues was slight, while in the tumour tissue it was twice that in normal mucosa. The results indicate that the tumour contained much more albumin than the normal gastric mucosa.

The post-operative course was entirely uneventful and the patient was discharged in good health at the end of two weeks.

At a follow-up study four months later he was feeling well in every way. The oedema had completely vanished after the operation. Serum protein and the ^{125}I -P.V.P. test (see Table) were normal.

COMMENT

The present case is of particular interest as the patient's actual disease—a gastric tumour—manifested itself exclusively by hypoproteinaemic oedema—that is, a case of “idiopathic” hypoproteinaemia.

The architecture of the polypous gastric tumour was very like that of the mucous membrane in “giant”

FIG. 2.—Resected part of stomach, showing the gastric polyp. Pyloric part on right.

FIG. 3.—Adenoma with several densely arranged glands lined with cuboidal-columnar epithelium.

hypertrophic gastritis (Menetrier's disease), in which hypoproteinaemia and a considerable protein loss in the stomach (Schwartz and Jarnum, 1959) is very common. It seems likely that in both cases the loss of protein occurs through secretion of protein-containing fluid into the gastric lumen. In actual cancer of the stomach, hypoalbuminaemia is a common finding and is due, at least partially, to gastro-intestinal loss of protein (Jarnum and Schwartz, 1960).

A conclusion to be drawn from our case is that the gastro-intestinal tract must be examined in all obscure cases of hypoproteinaemia.

This study was supported by grants from the Danish State Research Foundation and the King Christian X Foundation. We thank Dr. R. S. Gordon for a generous supply of ^{131}I -labelled polyvinylpyrrolidone.

J. DICH, M.D.
H. PAABY, M.D.
M. SCHWARTZ, M.D.

Copenhagen County Hospital in Glostrup,
Medical Department F and
Surgical Department D.

REFERENCES

- Gordon, R. S. (1959). *Lancet*, **1**, 325.
Gross, P. A. M., Embree, L. J., Bally, P., Shipp, J. C., and Thorn, G. W. (1960). *Amer. J. Med.*, **29**, 386.
Jarnum, S., and Petersen, P. V. (1961). *Lancet*, **1**, 417.
— and Schwartz, M. (1960). *Gastroenterology*, **38**, 769.
Lancet, 1959, **1**, 351.
Pearson, J. D., Veall, N., and Vetter, H. (1958). *Strahlentherapie*, Sonderb. **38**, p. 290.
Schwartz, M., and Jarnum, S. (1959). *Lancet*, **1**, 327.
— (1961). *Dan. med. Bull.*, **8**, 1.
Young, W. F., Fowler, J. F., Levin, B., and Miles, J. M. (1959). *Lancet*, **2**, 85.

Recurrent Rheumatic Chorea and Optic Atrophy after Occlusion of Central Retinal Artery

The following case is presented to illustrate the association of rheumatic chorea and C.R.A. occlusion in the absence of clinical evidence of carditis.

The patient, a 21-year-old married woman, was admitted to hospital at the beginning of July, 1960, suffering from severe chorea gravidarum. She was in the 23rd week of her second pregnancy and had felt nervous, and had been noticed to be excessively restless, for about two months. She had suffered from mild breathlessness on exertion since childhood, but this was no worse at the time of admission. Her left wrist had been swollen and painful for one week and she complained of a crop of ulcers in her mouth. Foetal movements had been felt for three weeks. Her right eye had been blind since sudden loss of vision in 1957. She had a history of several attacks of acute rheumatism and rheumatic chorea since childhood (see below). One of her sisters had died of acute rheumatism at the age of $7\frac{1}{2}$ years, and a brother had had erythema nodosum as a child. The remainder of her family were healthy.

On admission the patient showed gross choreiform movements of the face, hands, and legs, with some dysarthria, and had a slight, painful swelling of the left wrist and a crop of aphthous ulcers. She was clinically in the 23rd week of a normal pregnancy. The pulse was 80–100 and B.P. 110/70. There was slight clinical cardiac enlargement and a loud apical systolic bruit transmitted up the left sternal border, where it was accompanied by an early diastolic third sound. The second sound was closely split at the base.

The visual acuities were not accurately assessed on admission, but refraction on recovery from the chorea revealed that right vision was reduced to vague hand movements and perception of light in the temporal and inferior fields only. The left vision was improved from 6/60 to 6/6 with +4.0/

+0.50 $\times$ 90°. The pupils were equal in size but the right direct and left consensual light reflexes were diminished, the left direct and right consensual reflexes being normal. Fundal examination revealed bilateral hypermetropia and right optic atrophy. The retinal vessels were equal in size in the two eyes and of normal calibre, allowance being made for the hypermetropia.

Nothing significant was found on investigation other than a raised E.S.R. of 54 mm. in one hour (Westergren). The chorea was relieved by bed rest, sedation with phenobarbitone, and full doses of salicylates. The wrist became free from pain and the swelling subsided.

PAST HISTORY

I am grateful to Professor C. B. Perry, of Bristol University, and Mr. B. J. Bowden, of the Bristol Eye Hospital, for supplying the following details of the patient's past medical history and for permitting me to make use of them.

December, 1943 (aged 5 years): Attack of acute rheumatism; no clinical evidence of carditis; 1948: attack of rheumatic chorea; no clinical evidence of carditis; 1954: further attack of rheumatic chorea, again with no clinical evidence of carditis.

March, 1957: Sudden loss of right vision, when seen three days later by an ophthalmologist she was found to have the typical fundal changes of occlusion of the central retinal artery. The condition failed to respond to a retrobulbar injection of tolazoline hydrochloride. A presumptive diagnosis of embolism of the artery was made, though again no clinical evidence of carditis or other embolic phenomena was found. The patient gave a history, at this time, of periodic attacks of transient visual loss, affecting either eye for about a minute at a time, for six years, occurring as often as twice a day or at intervals of several weeks.

October, 1958: Normal delivery of first child after a normal pregnancy, though the patient thinks in retrospect she may have been rather restless during this pregnancy also.

January, 1960: Professor Perry discovered a loud apical systolic murmur for the first time.

COMMENT

The visual loss in the above case did not occur during an attack of chorea, but the rarity of C.R.A. occlusion in a patient of her age (18 years) points to an aetiological association of the condition and her rheumatic diathesis.

The most likely cause of the arterial occlusion would be embolism, but several factors weigh against this possibility: (1) the complete absence of clinical evidence of any form of carditis until almost three years after the visual loss, (2) the absence at the time of the arterial occlusion of other signs of embolic phenomena, and (3) the history of transient attacks of visual loss, culminating in the right C.R.A. occlusion, for a period of six years. The last factor points to these being attacks of spasm of the central retinal artery possibly associated with local arterial disease rather than multiple emboli, as recovery of vision between the attacks was said to be complete.

I thank the Director-General of Medical Services, Royal Air Force, for permission to publish details of this case.

G. S. WILLETTS, M.B., D.O.
Flight Lieutenant, R.A.F.

A new British Standard specification for anti-static rubber flooring (B.S.3398) has recently been issued. Copies may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London W.1. (Price 4s. each, postage extra to non-subscribers.)