VITAMIN "B" COMPLEX DEFICIENCY AS A CAUSE OF RETROBULBAR NEURITIS AND PERIPHERAL NEURITIS IN A CHRONIC ALCOHOLIC AND PIPE SMOKER

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Case history.—" A.B.", aged 46 years, publican, was admitted to Highgate Hospital on September 18, 1940, complaining of dimness of vision and of pins and needles sensations in his feet and hands.

Past history.—(1) He was discharged from the Navy in 1918 for " hyperthyroidism." His symptoms of tremors and excessive sweating completely subsided in two years. (2) Slight winter cough since 1920. (3) In 1930 he was treated for "lead poisoning" from which he made a complete recovery. The symptoms were confined to the abdomen.

Present history.—During the past six years he had symptoms of morning nausea and anorexia which had been getting progressively worse. He also vomited at times. The morning anorexia was so marked that for several months he was unable to eat any breakfast. A typical day's diet during the past few months was as follows. Breakfast: Nil. Dinner: Stewed rabbit or steak and boiled potatoes. Only very occasionally some boiled cabbage or beans. Tea: White bread and butter or margarine, tea and cakes. Supper: Fried fish, *e.g.*, haddock or plaice, white bread and butter and tea. His daily diet did not include wholemeal bread, raw vegetables, pork or liver. One month ago on awakening one morning he found that the vision of both eyes was blurred. This gradually became worse. At the same time he noticed numbness and tingling in the finger tips of both hands. This has persisted since. One week ago numbness and tingling developed in the toes of both feet and gradually crept up to the level of his knees, so that on admission he complained that his gait was unsteady.

Habits.—(1) For thirty years he had been drinking heavily. At first, beer only, but during the past ten years he had been taking about 1 pint of whisky daily and since the beginning of the present war he had exceeded that amount. (2) For the last thirty years he had been smoking about 2 oz. of shag weekly but since the present war this had been increased to $3\frac{1}{2}$-4 oz.

On examination, September 18, 1940, he was found to be well

built and well nourished. There was no evidence of hyperthyroidism. The tongue was moist and furred. There were diffuse sonorous rhonchi in both lungs and early clubbing of the fingernails. The blood pressure was 175/115 but no clinical enlargement of the heart was noticed. No evidence of arterio-sclerosis was found.

Central Nervous System.—His mental state was normal. Visual acuity of right eye: unable to count fingers at a distance beyond two feet. Visual acuity of left eye: unable to count fingers at a distance beyond one foot. The fundi were normal. Visual fields: obvious bilateral central scotomata were present. There was no nystagmus. Upper limbs: no objective lesion was found. Lower limbs: pin prick sensation was impaired below the level of the knees, with maximum impairment over feet. There was no obvious muscular wasting. Both calves were tender on compression. The right ankle jerk was greater than the left. The plantars were flexor and the other reflexes were also all normal. The joint sense in his big toes was not obviously impaired but Romberg test was positive.

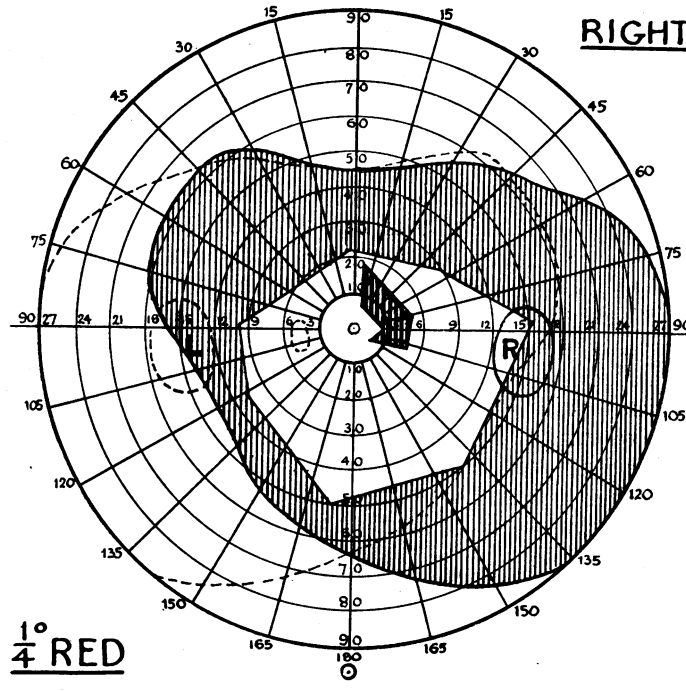
Investigations.—(1) Gastric analysis: Achlorhydria. No histamine was given.

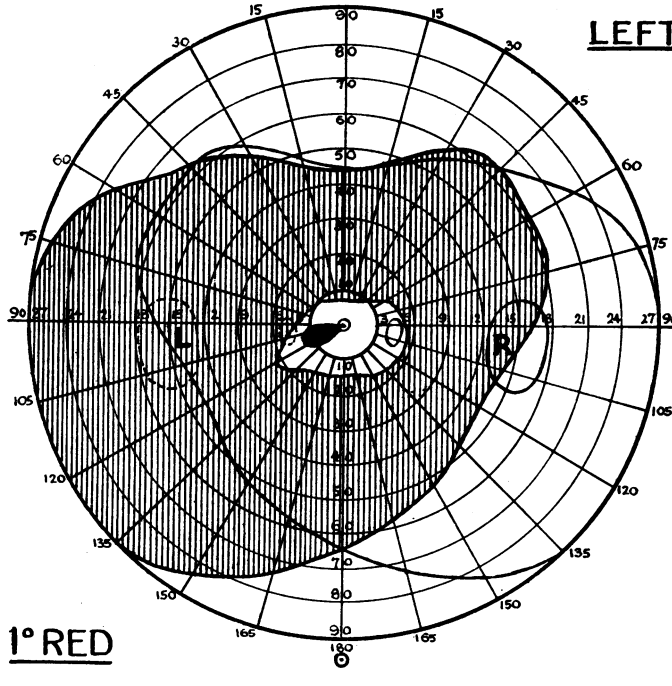
(2) Blood count: R.B.C. 5,440,000; Hb. 98 per cent.; W.B.C. 9,400; Polys. 45 per cent.; Eos. 2 per cent.; Lymphos. 47 per cent.; Monos. 6 per cent.

(3) Blood Wassermann test: negative.

Treatment and progress.—During his one week's stay in hospital he remained in bed and was given a full mixed diet—1 oz. Bemax t.d.s. by mouth and 2 mgm. vitamin B_1 was given intramuscularly daily. He discharged himself after one week as he then felt sufficiently well to return to work. He was advised to give up alcohol completely but was allowed to smoke as before; also to continue with the mixed diet and to replace white bread by wholemeal bread. He continued to take Bemax t.d.s. and 2 mgm. vitamin B_1 intramuscularly daily until October 22, 1940, five weeks after his admission. He then felt much better and his appetite was much improved, and now the vision of his right eye was 6/9 part and that of the left 6/36 part. He was only able to see the left half of the letters of Snellen's lines with his left eye. His gait was normal and Romberg test was negative, but he still complained of coldness and numbness of both feet. His hands were now free from symptoms. The intramuscular injections were now stopped and he was advised to take 1½ oz. Bemax t.d.s. On November 13, 1940, eight weeks after admission, R.V. was 6/6 and L.V. was 6/18 part.

He then went on holiday for two weeks and was told to discontinue tobacco in addition to alcohol in order to see if the





improvement would be expedited. Perimetric charts taken on November 13, 1940, were as shown :

Mr. G. G. Penman, the visiting ophthalmologist, reported on the perimetric charts as follows: " Right field approximately normal peripherally. To $\frac{1}{4}$° red object shows scotoma extending from blind spot above disc between 10° and 20° circle, resembling ' Seidel ' scotoma. Left field to 1° red object much constricted. Small scotoma between fixation point and 10° circle, in direction of blind spot."

On December 3, 1940, eleven weeks after admission, R.V. was 6/6, L.V. was 6/9 part. There was a left scotoma still present. The temporal half of the left optic disc was pale. He still complained of slight coldness of the calves and feet and there was some patchy impairment of the pin prick sensation over both calves. Right ankle jerk was still greater than the left. He had no pins and needles sensation in the fingers. The gait was normal. When next seen on January 6, 1941, he admitted that he had taken both alcohol and tobacco in a moderate amount for the past two weeks and that his vision had become blurred during the week. R.V. was 6/9, L.V. 6/12 part. He promised to abstain from alcohol in the future and to make this easier he was allowed to smoke. On January 28, 1941, R.V. was 6/6 part, L.V. was 6/9 part, left scotoma was still present, although less marked. The temporal part of the left disc was now definitely pale. Blood pressure was 165/105. When last seen on June 26, 1941, about nine months after his admission, he was feeling well and his appetite was normal. He stated that he was having a mixed diet including eggs, green vegetables and some wholemeal bread but had discontinued Bemax three months previously. He was taking an occasional beer but no whisky and was smoking as before. He had no symptoms or signs of peripheral neuritis. R.V. was 6/6, L.V. was 6/7·5. There was a central scotoma for red in the left visual field, while the temporal half of the left optic disc was pale. The B.P. was 175/115.

Comment

In the case described above, the symptoms and signs of retrobulbar and peripheral neuritis, which had been getting progressively worse, improved despite the continuation of tobacco. It would therefore appear that in this case tobacco was of little or no importance in the aetiology.

Following suggestions by Shattuck[1] and Minot[2], Wechsler[3] showed that hypovitaminosis was concerned in the aetiology of alcoholic polyneuritis. Strauss[4] further showed that nutritional deficiency rather than the toxic effects of alcohol were concerned in the causation. He allowed ten cases to take large doses of

alcohol with a full diet plus yeast, wheat germ by mouth, and vitamin B_1 and liver intramuscularly. Improvement occurred in every instance. Jolliffe *et al.*[5] analysed the diet of 42 alcoholic addicts of whom 26 had polyneuritis, and they found that:

(*a*) Every alcoholic addict with polyneuritis had an inadequate vitamin B_1 diet as estimated by Cowgill's formula[6].

(*b*) A chronic alcoholic with adequate vitamin B_1 intake did not have polyneuritis.

They thus concluded that vitamin B deficiency rather than the toxic effects of alcoholism caused the polyneuritis and therefore it is identical with dry beri-beri.

As regards retrobulbar neuritis, this is generally recognised to be due to both tobacco and alcohol. Traquair[7], however, states that in Britain tobacco is the only factor concerned in the aetiology and that alcohol merely depresses the health. Duke-Elder[8] quotes a Ministry of Health committee report of 1922 which was unable to find a single instance of retrobulbar neuritis due to alcoholism alone. Duke-Elder and Lindsay Rea both state that it does occur in heavy drinkers, especially on the continent of Europe and the former states that it is often associated with peripheral neuritis.

Retrobulbar neuritis has been described in association with other signs of vitamin B complex deficiency. Thus Calhoun[9] in 1918 described ten cases of pellagra in U.S.A. associated with retrobulbar neuritis. They had central or paracentral scotomata especially for red and green, and contraction of the visual fields. Some of the patients had optic atrophy. In a review of the literature he quoted several authors, including an Italian, Calderini, 1847, who stated that amongst cases of pellagra, 48 per cent. men and 72 per cent. women complained of disturbances of vision such as amblyopia or diplopia. Myashita[10] in Elliot's Textbook of Tropical Ophthalmology, 1920, quotes several Japanese authors since 1895, who described retrobulbar neuritis associated with beriberi. They had central or centro-caecal scotomata, especially for green. Visual acuity was never less than 6/60. Atrophy of the temporal half of the optic disc was noted and sometimes complete atrophy. The symptoms usually appeared about three months after the onset of beri-beri and improvement followed the discontinuation of rice and administration of Japanese beans. In post-mortem examinations he found limited optic atrophy in the temporal half of the disc. Fernando[11], 1923, also described beriberi associated with amblyopia in the Phillipine Islands, especially in parturient women. He stated that the vision was not much impaired and the visual acuity was 20/30. He found a low grade neuroretinitis with hyperaemic discs and blurred edges. The visual fields were contracted for green. Scott[12] in 1918 described an outbreak in Jamaica, confined to workers on a sugar

cane plantation whose diet consisted solely of sugar cane. They developed conjunctivitis, stomatitis and later either diarrhoea or nervous lesions, with residual dimness of vision, deafness and high steppage gait. The visual fields were normal. The outbreak terminated with the cessation of their work on the plantation. The optic nerves were found to be degenerated on post-mortem examination. He considered the conjunctivitis to be due to the irritating effect of the small hairs on the cane tops, and the other symptoms to be due to intoxication. But, in view of the diet, which consisted of carbohydrates only, *i.e.*, sugar cane, vitamin B deficiency was likely to have been the cause, particularly as it is now known that vitamin B_1 is concerned in carbohydrate metabolism and that the vitamin B_1 requirements are directly proportional to the amount of carbohydrate metabolised.[13] Moore[14], in Nigeria in 1932, described 70 cases of retrobulbar neuritis with loss of central vision in association wth sore mouth, tongue and vulva. They occurred in adolescents at school whose diet consisted of manioc (native carbohydrate food). The skin and mucous membrane lesions usually occurred before the retrobulbar neuritis. He found pallor of the temporal half of the optic disc or complete optic atrophy in advanced cases. Improvement occurred in the earlier cases following administration of marmite, cod liver oil and iron. The same author, in 1937[15], described this lesion in association with symptoms of peripheral neuritis in some of the cases. Improvement followed the administration of marmite or yeast. He concluded that these cases of retrobulbar neuritis were nutritional in origin and improvement was to be expected following treatment with vitamin B. Landor and Pallister[16], in 1935, described a similar condition in Malaya, occurring in institutions. Improvement followed the administration of yeast or marmite. Garcia Jimenéz[17], in 1940, described retrobulbar neuritis and symptoms of peripheral neuritis, in addition to glossitis and pellagra, among the civil population of Madrid during the Civil War. Their diet was inadequate in all requirements. Improvement followed the administration of brewer's yeast and he suggested that deficiency of the B_2 complex was the cause. Marchesini and Pagagno[18] showed degeneration of the optic nerves in pigeons fed on vitamin B_1 free diet. The degeneration was mainly of the papillo-macular bundle and they considered the lesion to be similar to that found in human beri-beri.

Retrobulbar neuritis has been described in association with alcoholic pellagra and beri-beri. Thus Cronin[19], in 1933, described a case of alcoholic pellagra, psychosis, polyneuritis and retrobulbar neuritis. This patient had a large blind spot in the right eye and pallor in the temporal half of the right disc. Improvement followed yeast therapy. Levine[20] in 1934 described a case of

alcoholic dermatitis and stomatitis which developed optic neuritis with congestion and exudates in the fundi. He found bilateral scotomata. This patient was a cigarette smoker. Improvement followed administration of Bemax, although he did not completely abstain from alcohol. Fine and Lachman[21] in 1937 described three cases of alcoholic dermatitis, peripheral neuritis and retrobulbar neuritis. They found central scotomata. Improvement followed the administration of yeast, liver, iron and parenteral liver. They suggested that vitamin G was the factor concerned in the aetiology. These patients were all cigarette smokers. Carrol[22] in 1936 described ten cases of alcoholic amblyopia, pellagra and polyneuritis. These patients were moderate smokers, mainly of cigarettes. The same author[23] in 1937 showed that diet was concerned in tobacco-alcohol amblyopia by admitting into hospital eight cases of amblyopia who were permitted to take both alcohol and tobacco but were given a full mixed diet with the addition of liver, cod liver oil, wheat germ and brewer's yeast. Improvement occurred in seven out of the eight cases. The unimproved case was an advanced one. He concluded that subnutrition, especially of vitamin B, increased the susceptibility to the toxic effects of tobacco and alcohol. Johnson[24] showed that vitamin B_1 was of value in the treatment of tobacco-alcohol amblyopia. Campbell and Ritchie Russel[25] in a clinical report of twenty-one cases of Wernicke's encephalopathy, due to various causes, including chronic alcoholism, mentioned that three cases had impaired vision. One of these had a central scotoma and papilloedema. Two had focal degenerative lesions in the optic nerves on post-mortem examination. In discussing aetiology and treatment they suggested that nicotinic acid and vitamin B_1 were concerned.

That nutritional deficiency is concerned in the aetiology of some cases of retrobulbar neuritis is made suggestive by its occurrence in pregnancy. Thus Kagan[26] described this lesion in a patient in three consecutive pregnancies. Central scotomata were noted. Interruption of pregnancy resulted in recovery of her sight. Lindsay Rea[27] described a case of bilateral retrobulbar neuritis which developed suddenly in the eighth month of pregnancy. Improvement of vision followed confinement, although two years later the visual acuity was still 6/60 in each eye. No details of the diet of these patients are available but as it is known that the vitamin B_1 requirements are increased in pregnancy, it is likely that they may have been suffering from conditioned vitamin B_1 deficiency. Ballantyne[28] recently, in a description of the ocular complications of hyperemesis gravidarum, showed that retrobulbar neuritis with central scotomata was the earliest eye lesion in this condition. He recommended treatment with vitamin B_1 and

possibly vitamin C. It would appear that this condition may be regarded as a conditioned deficiency of vitamin B_1 due to the vomiting, plus the increased requirements during pregnancy.

Retrobulbar neuritis has also been described in association with diabetes. Thus, O'Donaghue[29] described three cases in smokers. Recovery occurred although smoking was continued. No details of the diet are available but it would appear that some of these cases may have had a nutritional deficiency basis, due possibly to the low diets.

Conclusion

It is thus seen that bilateral retrobulbar neuritis (amblyopia) has been described in association with other evidences of vitamin B complex deficiencies. The deficiency may be actual as in beri-beri or pellagra, or, it may be a conditioned deficiency, as in chronic alcoholism with its associated achlorhydria, anorexia and vomiting, or pregnancy, especially hyperemesis gravidarum. It is likely that further research will show that amblyopia may occur as a result of other conditioned deficiencies such as persistent vomiting due to any cause or other gastro-intestinal disturbances which may interfere with the proper utilisation of the vitamin. Some cases of amblyopia in association with diabetes may also be found to be due to nutritional deficiency on investigating the diet.

In the case described above, there was actual vitamin B_1 deficiency in the diet, and achlorhydria due to the chronic alcoholism. Jolliffe *et al.*[5] suggested that in order to prevent peripheral neuritis in a chronic alcoholic, in addition to a full diet, fifty Sherman units of vitamin B_1 are required for each ounce of whisky or hundred calories of alcohol up to sixteen hundred calories, which is the maximum amount that can be utilised by the body. Here about 1·33 mgms. of vitamin B_1 will have been required for the utilisation of the alcohol alone. It can therefore be concluded that his symptoms of peripheral and retrobulbar neuritis were probably due to vitamin B_1 deficiency.

Summary

(1) A case of retrobulbar neuritis and peripheral neuritis is described in a chronic alcoholic and pipe smoker.

(2) Tobacco was of little or no importance in the aetiology.

(3) The literature is reviewed describing retrobulbar neuritis as occurring in association with other evidences of vitamin B complex deficiency.

(4) Alcoholic retrobulbar neuritis is considered to be due to vitamin B complex deficiency, probably vitamin B_1.

(5) Retrobulbar neuritis in pregnancy and some cases of retrobulbar neuritis in diabetes are probably due to vitamin B_1 deficiency.

(6) Vitamin B complex deficiency, probably vitamin B_1, was the cause of the retrobulbar neuritis and peripheral neuritis in the case described.

(7) It is suggested that all cases of bilateral retrobulbar neuritis should be investigated as regards the vitamin B content in the diet, particularly if associated with evidences of pellagra, beri-beri or peripheral neuritis and treated accordingly.

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REFERENCES

1. SHATTUCK, G. C.—*Amer. Jl. Trop. Med.*, Vol. VIII, p. 539, 1928.
2. MINOT, G. R.—*Ann. Int. Med.*, Vol. III, p. 216, 1929.
3. WECHSLER, I. S.—*Arch. Neurol. Psychiatry*, Vol. XXIX, p. 813, 1933.
4. STRAUSS, M. B.—*Am. Jl. M. Sciences*, Vol. CLXXXIX, p. 378, 1935.
5. JOLLIFFE, N., COLBERT, G. N., JOFFE, P. H.—*Am. Jl. M. Sciences*, Vol. CLXLI, p. 515, 1936.
6. COWGILL, G. R.—The Vitamin B Requirement of Man, New Haven, Yale Univ. Press, 1934.
7. TRAQUAIR, H. M.—*Edin. Med. Jl.*, Vol. XLII, p. 153, 1935 (Surgical Section).
8. DUKE-ELDER, W. S.—Text Book of Ophthalmology, Vol. III, p. 3019, 1940.
9. CALHOUN, P.—*Amer. Jl. Ophthal.*, Vol. I, p. 834, 1918.
10. ELLIOT, R. H.—Tropical Ophthalmology, p. 407, 1920.
11. FERNANDO, A. S.—*Amer. Jl. Ophthal.*, Vol. VI, p. 388, 1923.
12. SCOTT, H. H.—*Ann. Trop. Med. Parasit.*, Vol. XII, p. 109, 1918-1919.
13. WILLIAMS, R. R. and SPIES, T. D.—Vit. B.1 and its use in Medicine, 1938.
14. MOORE, D. F.—*West Afr. Med. Jl.*, Vol. V, p. 28, 1932.
15. MOORE, D. F.—*Lancet*, Vol. I, p. 1225, 1937.
16. LANDOR, J. V. and PALLISTER, R. A.—*Trans. R. Soc. Trop. Med. Hyg.*, Vol. XXIX, p. 121, 1935.
17. JIMENÉZ, GARCIA F.—*Rev. Clin. Espanola Madrid*, p. 231-8, Sept. 1940.
18. MARCHESINI, E. V. and PAGAGNO, M.—*Ann. di Ottal. e Clin. Occul.*, p. 63-81, Vol. LXIII, p. 81, 1935.
19. CRONIN, H. J.—*J. Nerve and Mental Dis.*, Vol. LXXVIII, p. 38, 1933.
20. LEVINE, J.—*Arch. of Ophthal.*, Vol. XII, p. 902, 1934.
21. FINE, M. and LACHMAN, G. S.—*Amer. Jl. Opthal.*, Vol. XX, p. 708, 1937.
22. CARROL, F. D.—*Arch. of Ophthal.*, Vol. XVI, p. 919, 1936.
23. CARROL, F. D.—*Arch. of Ophthal.*, Vol. XVIII, p. 948, 1937.
24. JOHNSON, L. V.—*Arch. of Ophthal.*, Vol. XXI, p. 602, 1939.
25. CAMPBELL, A. C. P. and RITCHIE RUSSEL, W.—*Quart. Jl. Med.*, Vol. X, p. 41, 1941.
26. KAGAN, Y. A.—*Sovet. Vestnik. Oftal.*, Vol. V, p. 503, 1934.
27. LINDSAY REA, R.—Neuro-Ophthalmology, 2nd Ed., p. 314, 1941.
28. BALLANTYNE, A. J.—*Jl. Obstet. Gynaec.*, Vol. XLVIII, p. 206, 1941.
29. O'DONAGHUE, D.—*Trans. Ophthal. Soc. U.K.*, Vol. LI, p. 637, 1931.