Critical Review.

THE MYOTONIC PUPIL: A CONTRIBUTION AND A CRITICAL REVIEW.

By

SMITH ELY JELLIFFE, NEW YORK.

IN 1932 Adie offered a condensation of some previous studies and sought to erect a new syndrome, consisting chiefly of tonic pupils and absent tendon-reflexes, which should be thought of as benign and to be separated from *tabes dorsalis*.

In his first contribution, made the year previously, the chief features of this syndrome were outlined: 'I wish to draw attention to a benign symptomless disorder characterized by pupils which react on accommodation and not to light and by absent tendon-reflexes.' Inasmuch as five of six cases reported came under his observation in a few weeks, he thinks it cannot be rare, but because of the possibilities of confusion with *tabes dorsalis* it merits recognition. Six case-histories are then reported briefly. In commenting on the pupillary signs he calls attention to certain variations which justify his title 'Pseudo-Argyll Robertson pupils.' In citing an early report of a patient with myotonic pupil by Wilbrand and Saenger, an 'imperfect stationary *tabes*,' he says:—'This is the only case resembling my own that I have been able to find in the literature.' He then later finds further observations from Moore and from Morgan and Symonds relative to the problem, and discusses the essentially syphilitic or non-syphilitic etiology of true Argyll Robertson pupils.

In a further study more specifically related to this latter problem Adie returns to the subject and in a post-graduate lecture outlines more in detail the matter of pseudo-Argyll Robertson pupils, a term which his colleague, Kinnier Wilson, some ten years or more ago, called a 'horrid expression.' Whether Wilson meant as horrid the abbreviated 'pseudo-Argyll' or its fuller form does not appear.

In his later contribution (1932) he finds a number of other cases spoken of as tonic pupillary reaction cases with absent tendon reflexes, beginning with one reported by Nonne (1902) in which the loss of ankle-jerks was thought to be due to a diabetic neuritis; Marcus' case (1906) might be congenital syphilis; Oloff (2 cases) (1914), no comment; Jess (1914), only right ankle-jerk absent; Lersperger (1914), no details (possible *tabes*);

Axenfeld (1919), probably congenital tabes (blood once suspicious); Gehrcke (1921), tabes; Behr (1921), ankle-jerks only absent; Weill and Reys (1926), polyneuritis and rheumatic fever or influenza; Moore (1931), 2 cases; and then his own 6 (1931) and 8 more in this article in *Brain*.

In a still later paper (1932) Adie again reviews the situation, this time in an ophthalmological journal, and would advance to the position of a 'name' for the disorder.

Adie's reprint of this paper and one by Guillain and Sigwald came to my desk the same day, and as each dealt with the specific problems here already broached as well as those of personal interest, I have been stimulated to call attention to some of my own observations which thoroughly justify Adie's belief that the situation 'must be common.' Whether one is correct in calling the syndrome a disease *sui generis* is doubtful.

Were my priority propensities in the ascendant I would call attention to early contributions of mine (1915-1921) in which the exact situation of modified Argyll Robertson pupils and lost tendon-reflexes, precisely as described by Adie, was reported and the danger of confusion with tabes accentuated in two cases of hypothyroidism. Inasmuch as I have seen both patients at times when they have relapsed from the use of their thyroid and have again had not only diminished tendon-reflexes and sluggish pupils (as they were called in my paper) but the actual tonic pupil on which Adie makes his differentiation, particularly in his paper in *Brain*, I have minded to make this short note.

I would also emphasize what I have already stated that in influenza, in encephalitis particularly, in diabetes and in alcoholic polyneuritis, as well as in hypothyroid states I have found these tonic pupils and lost tendon-reflexes. It is provisionally held to be chiefly a 'neuritic' syndrome and is not in my opinion entitled to a separate name. The isolated pupillary phenomena I have also seen in a pineal tumour (referred to by Wilson in 1921), also in tuberculosis of the apex, in disturbance of the sympathetic in the neck, and tuberculous gland operations and in other situations. I am convinced it is by no means a rare anomaly, as Gordon Holmes, Gehrcke and others have also reported.

Adie offers further synonyms for the pupillary reaction, such as 'pupilloctonia, myotonic reaction, tonic convergence reactions of pupils apparently inactive to light, Marcus' peculiar pupil phenomenon, non-luetic Argyll Robertson pupil, pseudo-Argyll pupil' (see Bing and Franceschetti, l. c., p. 126); these are at times present and at other times atypical of the tonic pupil. In a rather laboured way he differentiates (A) a complete form in which one or both eyes show the tonic convergence reaction in a pupil apparently inactive to light, with absence or diminution of one or more of the tendon-reflexes; and (B) incomplete forms, with (1) tonic pupils alone, (2) atypical phases of the tonic pupils alone, (3) atypical phases of the tonic pupil with absence of reflexes, and (4) absent tendon-reflexes alone.

He has found a preponderance of females, and in a ratio of 4:1 only one eye is involved. In this paper he describes at length the fairly well known variations in pupillary contractility, paying special attention to that type of contracted non-light-reacting pupil which nevertheless dilates slightly in a dark room and then on exposure to light contracts even smaller than before and then enlarges a trifle. This may occur in one or both eyes. Another feature is no loss of accommodation reaction: also that these may or may not be immobile pupils to convergence. No mention is made either of the consensual light reaction, or of the sympathetic reaction to pinching of the cheek, nor do we find any notes made upon the acoustic pupillary reflexes.

As for the occurrence of various gradations in the Argyll Robertson pupil, especially that variant called by Saenger the 'myotonic pupil' and the 'pseudo-Argyll Robertson' pupil by Adie, even a cursory glimpse at ophthalmological and neurological literature seems to indicate that the fluctuations and modifications are so numerous that it is an arbitrary matter to make hard and fast distinctions. Even in the development of the classical tabetic pupil there are cases in which the pupil goes through a 'myotonic stage,' and the literature seems to indicate much the same in other neurological situations. Even extreme Argyll Robertson tabetic and parietic miotic pupils are not absolutely stiff when examined in a dark room with lenses (see Bing and others).

With a proper microscope and pupillometer these fine gradations are readily observed and recorded. As is well known, 'miosis' for Bach is 2.5 mm., for Shirmer 2.0 mm., and for Uhthoff 1.5 mm. In much the same manner of scale—from fixed, to almost fixed, to the 'Erholungs'-pupil in the dark, to even lesser degrees of loss of light reflex, or prompt or less prompt reaction to cocaine or homatropine—common sense recognizes tendencies rather than strict mathematical confines. We find Adie's grades A and B, 1, 2, 3, 4, rather academic.

A cursory glance at this same ophthalmological and neurological literature also reveals a multiplicity of situations, in which the 'myotonic' pupils, as of the type here under consideration, are to be found. Some are reported as in 'normal' individuals; just as abolition of the knee-jerks is found in 1 to 2 per cent. of 'normal' people. An industrious compiler undoubtedly will find a motley group of myotonic pupil cases. An initial search in Bach, in Bumke, in Behre, Best, Bing (see Schieck and Brückner, p. 126, for example) reveals scores of them. In diabetes, in polioencephalitis, poliomyelitis, influenza, cervical rib, injury to cervical plexus, thyroid operations, œsophageal operations, neck operations, apical tuberculosis, alcoholism, injury to skull, delayed apoplexy, the feeble-minded, catatonics, syringomyelia, multiple sclerosis, aortic aneurysm, cervical pachymeningitis, Thomsen's disease, etc., they are found, so that Bach writing even 10 years

ago says he has observed the myotonic reaction 'often' (p. 141) and that 'it possesses no diagnostic significance' (p. 144).

About loss of tendon-reflexes the situation is not so clear-cut, but here also there are many non-syphilitic factors that can bring about loss or great diminution of tendon-reflexes. The literature is vast and need not be entered into here.

The combination is undoubtedly rarer, but it too I believe is not so rare, and I am convinced it is not a specific syndrome in the sense of Adie.

Looking through the case-histories quoted as related to the syndrome, one finds that Holmes alone refers to thyroid states. In two of his patients the thyroid was enlarged and in one there had been a history of hyperthyroidism in earlier life, but there are no observations on any result of such modified thyroid states, if any, even though it is well recognized that hypothyroidism not infrequently follows hyperthyroidism.

It would be an absurdity on my part to assume that Dr. Adie is not familiar with many of these facts. The patients whose histories he has presented were probably not postencephalitics, nor did they have mesencephalic brain tumours, nor possibly (?) any of the conditions here mentioned as giving rise to varying degrees of 'tonic' pupils. The evidence presented in the short histories, however, does not exclude some of the more frequent—even if but transitory—causes for the appearance of such tonic pupils. Among these, for example, alcoholism, influenza, beginning psychoses, ear disorders, psychoneuroses, tuberculosis, hypothyroid states must be considered. But even if the examinations had been extremely meticulous still it would remain a doubtful issue whether one could erect a disease *sui generis* upon a type of syndrome both aspects of which are in reality of widespread occurrence—tonic pupils and diminished knee-jerks.

Further, in following out Guillain and Sigwald's interesting communication I note that several issues pertinent to Adie's papers are discussed. In the first place, while agreeing in part with Adie's conception that such cases of tonic pupils and absent tendon-reflexes are met with (they report two such in this present communication) they are of the opinion that the interpretations given by Adie are not satisfactory, particularly when he would ally his cases with the myotonic dystrophies, periodic palsies or myasthenia. This, however, brings up other possibilities for the syndrome. In discussing the areflexia aspects of the situation they also disagree as to the vegetative nerve implications, in view of the known areflexias of more distinctly neuritic origin. They also take up a number of points concerning the true Argyll Robertson pupil as occurring in other conditions than in syphilis, about which Adie makes the categorical statement, 'The true Argyll Robertson phenomenon is an infallible sign of syphilis'—a position from which Bing has retreated after stoutly maintaining it for years. Wilson has covered this situation in his 1921 paper and later contributions. Guillain

and Sigwald quote a number of their own observations which run counter to this statement of Adie's.

Finally, Guillain and Sigwald come to regard the syndrome as of a toxic-infective nature of unknown origin, whereas I would maintain the same position, except that in some instances the toxic or infective process is obvious—diabetes, influenza, alcohol, etc., and sometimes not so certain—hypothyroid state, etc.

Inasmuch as my contribution (1921) has escaped the search of Adie, and as an earlier paper (1914) dealing with one of these patients has only been published in short abstract, I feel justified in citing them again with additional notes on the case of L. T., whom I saw later in 1918 and have heard from since. The other patient has been lost sight of for some time.

PERSONAL CASES.

CASE I.—Mrs. X., first seen November, 1913, 54 years of age, twice married, at 19 and at 27. First husband died of tuberculosis. She had much economic worry. Two children of this marriage; second marriage four children. General neurotic history. No alcoholism and no history of abortions, or skin eruptions. Some thinning of her hair. Menopause at 45 with exaggeration of neurosis.

She came with several documents of previous examination from competent physicians and neurologists, one or two of whom diagnosed *tabes dorsalis*.

She had had neuralgic pains in the arms and legs almost crisis-like in their severity and mode of occurrence. There were three attacks of what might erroneously be taken for gastric crises in the two years before 1913.

Notes of examination, somewhat more fully reported than in the brief communications made in 1914 and 1921, showed a somewhat stout and heavy woman. The skin was thick, slightly pigmented, and dry and slightly scaly. It did not pit on pressure. She had noted she did not sweat much. The skin felt like marble to the touch. She was always chilly. The hair was thin and shedding, the eyebrows particularly were scanty, the nails fragile. The lips were somewhat thick; the mouth and slightly thickened tongue were dry, and the latter marked by the teeth. The abdomen was fat. The joints were painful and stiff. The pulse was slow; mostly about 54-60. She was constipated and slightly anæmic.

Neurologically: She was not taken up with her food and the nuances of smell were distinctly not interesting. The eyesight was unaltered. The fundus showed no marked anomalies. The pupils were unequal, the left 5 mm., the right 2 mm. There was a marked sluggish light reflex in both eyes which was more striking in the dark room. She had a typical myotonic pupil. The convergence reflex reaction was present. There was a definite sympathetic reflex to pinching the cheek but the consensual light reflex was even less present than the direct, but very minutely present in the right eye more than the left. There were no ocular palsies. The palpebral fissures were slightly unequal. No nystagmus. The functions of the fifth and seventh nerves were without marked anomalies. Hearing was defective. Rinné +, i.e., bone conduction was as good as air conduction. There was no marked defect in equilibration. Saliva was thick and ropery.

Upper extremities showed no atrophies, hypertrophies, anæsthesiæ or paralyzes. There was some hypotonia and not over-active elbow and wrist

tendon-reflexes. No ataxia in finger-nose and finger-finger tests; no astereognosis, no bone sensibility changes; no thermal sensory defect.

Trunk: Abdominal reflexes sluggish (fat). Constipation: no bladder disturbances.

Lower extremities: As upper, but some nerve tenderness on pressure and more definite loss of tendon-reflexes, especially knee-jerk and achilles-reflex. Jendrassik's method reinforced the scarcely elicitable knee-jerks. No ataxia, no Romberg's sign; knee-heel test was normal. Bone conduction, discrimination, normal. Position sense normal. No heat or cold losses, nor fine sensibility changes. No girdle sensation.

In the blood and spinal fluid the Wassermann test was negative: only 1-2 cells per c.mm. were present in the latter.

Mentally she was slow and heavy. There were no psychotic symptoms, but she had a host of neurotic complaints not necessary to detail here.

A diagnosis of hypothyroidism was made and she improved progressively under thyroid and Lugol's solution. At times she could not afford to buy the 2-5 grains of thyroid ordered and she would relapse. The special point to be emphasized was that both the pupillary and tendon reflexes improved very definitely, to relapse with the general mental state as she became careless in medication. She was seen fairly consecutively once a month for two and a half years, and then a few times in 1919 and once in 1920, since which time no word has been received although follow-up letters have been written. Every time she took her thyroid regularly she improved particularly as to the mental state and as to her neuritic condition. She had one of the 'gastric' attacks in six years observed.

CASE II.—Mrs. Y., married, aged 36 in 1917 when seen as a patient. I had known this young woman for some years. She was a friend from childhood of an assistant of mine in the medical school. She was then about 20 or 21 years of age, a bright active alert young business woman, a highly competent secretary judged by the salary she earned and the steadiness of her employment in very responsible corporations and her intelligent industrious capacities.

I copy the history as reported in 1921 with slight addition from my notes.

She had a very complicated and full history from the time of her youth, which was made difficult by a religious fanatical father, followed by a seduction by a physician at sixteen. One sister died of tuberculosis and one sister was epileptic (completely negative luetic tests of this sister at Craig Colony, N.Y.). She then went on the stage, as a chorus girl, where she remained for two years. She then had a Neisserian infection, later, at twenty, severe scarlet fever with arthritis, and later a salpingitis required a complete hysterectomy in 1907. She was very intelligent and capable, she made good and had held for some years a very responsible position as private secretary with large corporate interests, and when I saw her, for the present difficulty, she was married, a woman of social position, means, accomplishment and charm, in spite of the adverse beginnings.

She had consulted her physician who, on reference to a local specialist, had told her she probably had a beginning of locomotor ataxia. She later came to New York on a motor trip which was hurried and only permitted a cursory examination.

The salient features of her early social history were as noted. In addition in 1900 she had had a 'big fever sore' on her lip which had lasted several

weeks. The doctor burned it and there was a hole for two to three weeks. There were no eruptions of any form following this. In 1904 she had an ulcer on the left thigh.

The present situation began about 1916. She had feelings of great uneasiness: shooting pains in the legs and arms; at times a band of anæsthesia unevenly distributed about the waist. Previously and about one or two years after the hysterectomy, she occasionally had severe attacks of projectile vomiting, lasting two days. At times she would have two of these in a year. The pain and cramps were terrific; she had not had one for over a year, but while in New York had a very severe attack of diarrhoea with cramps and pains which she said were a sort of incomplete or modified stomach attack. She was always cold and 'goosefleshy'; had frequent and severe colds; was nervous and fidgety; shook all over; was usually constipated, save when the periodic diarrhoeas took place. In June, 1917, she had a circular zoster attack, with areas of paræsthesiæ of a 'creeping' or 'crawling' kind that persisted.

Examination at this time showed a well built woman with moderate adiposity. The skin was hard, cold and marble-like, very pale and anæmic. Goose fleshing was evident; the pilomotor reflexes irregularly hyperactive. Red dermographia was present and of moderate intensity. The eyebrows were very thin and the nails were fragile, the hair also. No sweating.

There was slight dulness in both apices. Whereas the skin in general was was cold and pallid and marble-like, she had the bright red cheeks of the English girl (she was born in Canada). She had some tachycardia at times although the pulse generally was slow. There were no other noteworthy general features. The lips were not markedly thickened nor the tongue swollen although the mouth was dry.

Neurological Examination: Patient had had since birth a slightly twisted nose and she said she had always felt she did not smell well. The eyesight was excellent. The fundus showed no changes. Pupils reacted slowly to cocaine when fundus was examined. The ocular movements were ample and free in all directions. Slight palpebral fissure irregularity. There was a definite inequality in the pupils. They were both under 2.5 mm., the right being the smaller by 1 mm. at least. The direct light reaction was very sluggish; classically myotonic. In the dark room it was more active, and there was slight slowness of the convergence reaction which was less marked in the dark room. The sympathetic reflex was present. The consensual light reflexes were not elicited. She had never had diplopia. There was no nystagmus. Fifth and seventh nerve functions normal. Hearing was less in the right ear (scarlet fever?).

Upper Extremities: Beyond the dermographia there were no objective findings in the upper extremities. There were no ataxias; no tender nerve-trunks; no appreciable losses in tendon-reflexes.

Trunk: No objective findings. No anæsthesia, or girdle sensation. Marked red dermographia persistent.

Lower extremities: No paralyses. Legs felt heavy. There was a very slight swaying when standing on one leg. Both knee-jerks were diminished and achilles-reflex absent. There was no ataxia on knee-heel tests. No loss of bone conduction. Position sense normal. Cold extremities. Sensory discrimination of all qualities normal.

Laboratory findings: Blood: 2 per cent. eosinophils. Blood pressure 155/105. Negative blood and spinal fluid Wassermann test; 7 cells per c.mm. Faint trace of globulin. No sugar. There were two later repetitions of the laboratory tests at six months' intervals (one at St. Luke's Hospital, New York); all

tests negative: 2 cells and 5 cells, respectively. There had been, previous to my seeing her, one reported plus blood Wassermann from a local laboratory.

A course of one hundred one-grain tablets of desiccated thyroid with cooked thyroid once or twice a week was advised. The local neurologist was written to that a dysthyroid syndrome was possible (after hysterectomy, overcompensatory gonadal thyroid activity with thyroid exhaustion) (she had had some slight swelling of the thyroid after the hysterectomy), and a careful revision of the material was suggested, since she showed unmistakable dysthyroid vagotonic stigmata.

The war activities withdrew all medical supervision and as the patient was a long way off in Western Canada it was difficult to trace further the situation from a technical point of view. She grew better, intermittently. At one time in 1919, following a continuous use of thyroid, the puffiness in the neck returned, her breathing was affected, headaches increased; she became jumpy. These symptoms disappeared after discontinuance of the drug.

The last reports in 1920 were that she had had no gastric attacks, no diarrhoeas, no constipation. The arthritis was better, the pains were gone, her fatigue was better, though she had not the endurance of former days. Long letters indicated also definite unconscious psychogenic factors of difficult adjustment with reference to frigidity.

DISCUSSION.

There is little need for extended discussion. Concerning the signs of minor hypothyroid disturbance, Levi and Rothchild have summarized them with great precision and for the main it is well to recognize that scanty hair distribution, frilosity, arthritic, neuritic, and trophic disturbances may arise on the basis of dysthyroid function. The patients illustrate that there is a certain trend in a submyxoedema which may be confused with a tabetic syndrome.

One or two points may be touched upon which are of less well recognized significance, and as certain of these features run across the typical tabetic trail they may be commented upon, leaving for a future time a more extended and elaborate discussion.

It would appear that the dysthyroid condition can bring about a typical vagotonic state which can give rise to the characteristic crises of a similar vagotonic state which lies behind the crises of tabes. Eppinger has already suggested the explanation of the crises of tabes on a vagotonic hypothesis. Hence these ideas may be extended in two directions. The one has already been suggested; the other is that in tabetic pathology the fact of vegetative sympathetic pathways becoming more seriously involved in certain points permits the vagotonic reaction; and that it is possible that concomitant dysthyroid pathology is a factor in the constellation of the constitutional pathology to aid in the production of crises of many kinds. Hence it may be read that the syphilitic infiltration process in the incoming vegetative fibre-pathways, plus the dysthyroid modifications of the effector pathways, plus other factors (I myself have insisted that psychogenic factors may be added

in the constellation, in some instances bringing about the dysthyroid function) results in the crippling crises of tabes.

I am also disposed to analyze the tabetic arthropathies along similar lines of a 'constellation pathology.'

The pupillary reflex pathway modifications are probably much more complex, since the phyletic complications of the evolution of the light receptor mechanism of the eye are as yet far beyond our ability to unite into a satisfactory generalization. The vegetative reflex arcs of the intestinal and bone integrations, though still far from being completely resolved, yet are probably much simpler in their phyletic history and hence nearer being satisfactorily explained by our present day intellectual symbols.

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