

VISUAL SYMPTOMS CAUSED BY DIGITALIS*

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The purpose of this paper is to report the visual symptoms which occurred in 6 patients taking digitalis. In 3, general symptoms of digitalis intoxication caused the patient to return to his internist for advice but the other 3 came directly to me because of visual disturbances. None of these suspected digitalis as the cause and none gave me a history of taking digitalis until specifically asked about it. These 3 showed no other signs or symptoms of digitalis intoxication except for the visual complaints and so it was natural for them to consult an ophthalmologist rather than the physician who had prescribed the cardiac drug.

That digitalis may cause visual disturbances has been known for at least 159 years. In 1785 William Withering¹ in his classical paper on the foxglove stated that it might result in "confused vision, objects appearing green or yellow" when given in large doses. Although the general literature contains numerous references² to this subject very little concerning this condition could be found in the American ophthalmologic literature.³ Paul D. White,⁴ the prominent Boston cardiologist, recently stated that he sees "several such patients a year who had just enough oversaturation with digitalis to have developed these eye symptoms" but he feels "quite sure that the average doctor does not inquire about them." In speaking with internists it is also my impression that the condition is not well known to them and I think it is even less well known to ophthalmologists.

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The general symptoms are usually much more prominent than the visual disturbances. The most common^{2, 9} are anorexia, nausea, and vomiting, and occasionally diarrhea. These symptoms are not due to any effect on the gastrointestinal tract but are central in origin—just as the eye symptoms are probably central in origin. There may be marked slowing of the heart rate and the electrocardiogram may show a characteristic graph. The central nervous system infrequently reacts by depression or excitement, headache, impairment of memory, confusion, or delirium.⁸

TABLE 1

<i>Name</i>	<i>Sex</i>	<i>Age</i>	<i>Dose—Powdered Leaf Tablet Form</i>	<i>Symptoms</i>	<i>Vision</i>	<i>Eye Pathology</i>
U. N.	F.	42	Maintenance dose—0.1 Gm. daily	Snow on everything	20/20 O. U.	None
J. L.	M.	43	0.3 Gm. daily—3 Gm. in 10 days	White and yellow snow	20/20 O. U.	None
J. B.	F.	75	Maintenance dose—0.1 Gm. daily	Bright shiny spots, sees "diamonds"	20/100 3/200	Diabetic retinopathy—lens opacities
J. F.	F.	85	0.2 Gm. daily for 30 days followed by 0.3 Gm. for 2 days	"Nearly blind" flashing lights—nausea	20/70 O. U.	Lens and vitreous opacities
D. K.	M.	33	4.4 Gm. in 10 days (Pt. weighed 275 lbs.)	Red and green spots—nausea	20/20 O. U.	None
H. M.	F.	41	0.4 Gm. daily for 7.9 days	"Black lines," "glare," green vision, nausea, vomiting	20/20 O. U.	None

The visual symptoms of the patients seen by me were as follows (Table 1). Two stated that snow seemed to cover everything at which they looked. My face seemed to have snow on it. One colored man said my face appeared covered with "sulfur" or "yellow snow." When he closed his lids he saw yellow flowers dangling in front of his eyes. One woman saw bright shiny objects which looked like goldfish and complained of lights flickering. Another saw bright and dark

spots. A physician who before taking digitalis noticed black specks floating before his eyes complained that these specks had turned to red and green spots. He said that he had always had muscae volitantes but they became colored after taking large doses of digitalis. The sixth patient said everything was green. She kept in a dark room because of the "glary brightness."

The white vision of which 2 of these patients complained is mentioned in the literature. One man,⁵ on looking from his hospital window, saw white automobiles traveling along the street. His daughter, dressed in a dark blue coat, came to visit him and he asked her when she had obtained her white coat. He then thanked her for the white flowers she had brought him—they were actually red tulips. The colored vision may also be green, blue, yellow, or red. Flickering and flashing of light are said to be early symptoms.² Purkinje,⁶ in 1825, experimented on himself and he noticed light flashes, flickering, and flowerlike figures in the center of his visual field.

This condition frequently recurs. One of the above patients had a previous attack of green vision associated with nausea and vomiting. She judged her recovery by looking at the apparent color of her skin. After the drug was stopped for a few days she said that at times her skin appeared normal in color—at other times it still seemed green. Jackson⁷ reported a case of yellow vision which cleared up spontaneously in 5 weeks, reappeared a year later for 8 weeks and had a third attack which was accompanied by such general disturbances that hospitalization was sought and the true nature of the visual disturbances finally discovered.

The visual acuity, fields, and fundi of the patients seen by me were unaffected by the digitalis when I examined them. Despite all the symptoms mentioned above there was nothing to be found objectively. One patient stated that in a previous attack she had lost the sight in one eye and she had been unable to read with that eye. Jackson⁷ wrote that his

patient was unable to read the largest type in the newspaper but 9 days after discontinuing the drug "she could read the finest print." He states that at times she had double vision and often the right side of an object disappeared before her eyes. Smith⁸ mentioned blurring of vision, scotoma, diplopia, and colored vision. One report² by a cardiologist describes a patient receiving digitalis in normal doses who developed "almost complete blindness" but ophthalmologists could find nothing wrong and finally the possibility of digitalis amblyopia was considered; the drug was stopped and the sight returned completely. Another article¹⁰ mentions a temporary complete blindness as well as an amaurosis which lasted 3 days.

How are we to interpret these reports? The most likely interpretation to me seems to be this: digitalis acts on the central nervous system; it stimulates centers in the medulla which cause nausea and vomiting; it probably involves the cerebrum causing the visual hallucinations. The colored vision is really a hallucination. The confused vision is due to central functional impairment due to the drug. Colored positive scotoma were present in one of my cases and are mentioned in the literature. I have been unable to find any actual recording of visual field changes. Sometimes, as mentioned, there is some mental impairment but my patients knew they were perceiving something that did not exist. The temporary complete blindness mentioned in the literature probably was due to cerebral intoxication, *i.e.*, a cortical type of blindness which disappeared on stopping the drug.

The dose of digitalis required to produce visual symptoms is variable. Two of my patients were on what is considered a normal maintenance dose (Table 1). They were receiving $1\frac{1}{2}$ gr. (0.1 Gm.) daily of the powdered leaf, *i.e.*, 1 cat unit, which is approximately the amount utilized daily.¹¹ They had no other signs or symptoms due to the digitalis except the visual disturbances. The other patients received larger doses. This was sometimes the fault of the patient who mis-

understood the physician's directions and sometimes it was the fault of the internist. All received the dry powdered leaf in tablet form made by reputable pharmaceutical companies. The exact component in the drug responsible for visual symptoms is unknown but the most refined preparations may produce these symptoms as well as the crude preparations used many years ago. It does seem important to know however that on the dosage recommended in leading textbooks on cardiology¹¹ a patient may, infrequently, develop visual disturbances without any other symptoms.¹² These patients usually can take smaller doses without difficulty. Recovery from the visual symptoms after stopping the drug took from 3-7 days in my cases but it may take as long as 14 days.¹³ Overdosage has resulted in death¹⁴ but apparently if the patient recovers, the vision recovers and I have so far been unable to find any convincing report¹⁰ of permanent visual impairment. The only treatment usually necessary is to stop the drug; the forcing of fluids may be desirable but should probably be prescribed by the physician in charge of the patient's cardiac condition.

The diagnosis may not always be easy. One of the author's patients who complained of black floating specks and bright shiny spots had vitreous opacities and a diabetic retinopathy which was thought to be sufficient to explain her symptoms. However when she discontinued her normal maintenance dosage of digitalis the annoying bright spots disappeared leaving only the others to which she had long been accustomed. She is able to take about half the average dosage without developing symptoms. Another elderly patient with lens and vitreous opacities complained of black streaks and flashing lights. It was only by stopping the drug temporarily and having these symptoms disappear that the diagnosis was made certain. Usually however if the possibility of this condition is kept in mind there will be little difficulty in making the diagnosis.

SUMMARY

This is a report of 6 patients who had visual symptoms due to digitalis. These consisted in colored vision chiefly white, green, yellow or red, flashes of light, positive colored scotoma and other visual hallucinations. There was no change in the visual acuity or fields of these patients but the literature suggests that if the intoxication is sufficiently profound a temporary cortical type of blindness may result. This condition may occur in patients receiving what is considered a normal dosage of the drug and may be the only symptom present. Recovery takes place within 2 weeks after stopping the digitalis.

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DISCUSSION

DR. T. H. JOHNSON, New York City: The hallucinations in Dr. Carroll's cases could have been caused by a toxic effect of the digitalis on the retina or on the higher visual centers. There are two areas in the occipital cortex which respond to stimuli, the visio-sensory and the visio-psychic centers. Stimulation of the visio-sensory area may produce hallucinations which consist of flashes of light, luminosities, or spectral appearances, while stimulation of the

visio-psychic area recalls stored memory pictures and reproduces panoramas, pictured scenes, and scenes of action. The theory generally accepted is that crude visual hallucinations are the response to stimulation of the conduction tracts or higher centers in the occipital lobe while complex phenomena are the result of the stimulation of the afferent visual pathways. However, it is well known that local lesions in the retina produce crude hallucinations. We have all had cases in which local changes in the retina have produced flashes of light and luminous scintillations, and there are many reports in the literature of crude hallucinations which were caused by local retinal lesions. The temporary loss of vision may be explained by the fact that the retinal arteries may have become spastic under the influence of the drug causing a temporary loss of vision such as is often seen in arteriolar spasm in arterial hypertension. It would be hard to differentiate between an obscuration of vision caused by spasm of the retinal arterioles and that caused by spasm of the arteries in the occipital lobe.

DR. CARROLL, closing: I want to thank Dr. Johnson for his remarks. We can all profit by going back and reading his thesis on visual hallucinations presented before this society some years ago [1933]. It still stands as one of the outstanding works on this topic. As to his suggestion regarding the possibility that the visual symptoms due to digitalis may be associated with a vasospasm of the retinal vessels, I have not observed any such change and think in all probability there is a direct toxic action on the cells of the central nervous system.

Dr. Gillette of Syracuse had, I think, made an important contribution on this subject. He has just sent me the report of two cases of retrobulbar neuritis due to digitalis. Both had central scotomas and marked reduction of vision. Both recovered promptly when the drug was stopped. One had a temporary recurrence when again placed on the digitalis. This quickly disappeared after stopping the drug. So far as I know these are the first definite cases of retrobulbar neuritis due to digitalis clearly described, and I hope he will report them to us in detail.