

# **Nitro-glycerine as a remedy for angina pectoris / by William Murrell.**

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NITRO-GLYCERINE

AS A

REMEDY

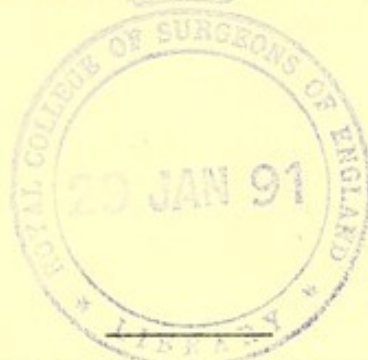
FOR

ANGINA PECTORIS.

BY

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## NITRO-GLYCERINE AS A REMEDY FOR ANGINA PECTORIS.

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SOME twenty years ago a controversy arose in the pages of the *Medical Times and Gazette*, on the properties, physiological and therapeutical, of the substance known to chemists as nitro-glycerine. The discussion was opened by Mr. A. G. Field, then of Brighton, who described in detail the symptoms he had experienced from taking two drops of a one per cent. solution of nitro-glycerine in alcohol. About three minutes after the dose had been placed on his tongue he noticed a sensation of fulness in both sides of the neck, succeeded by nausea. For a moment or two there was a little mental confusion, accompanied by a loud rushing noise in the ears, like steam passing out of a tea-kettle. He experienced a feeling of constriction around the lower part of the neck, his forehead was wet with perspiration, and he yawned frequently. These sensations were succeeded by slight headache and a dull, heavy pain in the stomach, with a decided feeling of sickness, though without any apprehension that it would amount to vomiting. He felt languid and disinclined for exertion, either mental or physical. This condition lasted for half an hour, with the exception of the headache, which continued till the next morning. These symptoms Mr. Field describes as resulting from a single dose of one-fiftieth of a grain. Thinking that possibly he might be unusually susceptible to the action of the drug, he induced a friend to take a dose. The gentleman experienced such decided effects from merely touching his tongue with the cork of the bottle containing the nitro-glycerine solution that he refused to have anything more to do with it. A lady suffering from toothache, on whose tongue Mr. Field placed about half a drop of the same solution, experienced a pulsation in the neck, fulness in the head, throbbing in the temples, and slight nausea. The toothache subsided and she became partly insensible, disliking much to be roused. When fully sensible she had a headache, but the toothache was gone. Another of Mr. Field's patients, a stout, healthy young woman, accidentally



swallowed a small piece of lint dipped in the nitro-glycerine, whilst being applied to a decayed tooth. In about five minutes, after feeling giddy and sick, with headache, she became insensible. Her countenance, naturally florid, was unaltered, breathing tranquil, pulse full, and rather quickened. She recovered in about three minutes, after the administration of a stimulant. Some headache was complained of, but the toothache was gone. Mr. Field, in conclusion, offered some suggestions as to the therapeutical uses of the drug, and stated that he had not met with a single well-defined case of neuralgia or spasmodic disease in which it had failed to afford some relief.

This paper was followed by a letter from Dr. Thorowgood, in the main confirmatory of Mr. Field's observations. He, after taking a small dose, 'experienced a tensive headache over the eyes and nose, extending also behind the ears, and soon followed by a tight, choking feeling about the throat like strangulation. Neither loss of consciousness nor nausea was experienced, and a walk by the sea soon did away with the unpleasant feeling.'

These statements did not long remain unchallenged, their accuracy being called in question by Dr. George Harley, of University College, and Dr. Fuller, of St. George's. Dr. Harley, having obtained some nitro-glycerine of the same strength as Mr. Field's, commenced his observations by touching his tongue with the cork of the bottle containing the solution. He experienced "a kind of sweet and burning sensation, and soon after a sense of fulness in the head, and slight tightness about the throat, without, however, any nausea or faintness". After waiting a minute or two these effects went off, and Dr. Harley was inclined to think "they were partially due to imagination". Determined, however, as he says, to give the drug a fair chance, he swallowed five drops more, and as this did not cause any increased uneasiness, he took, in the course of a few minutes, another ten drops of the solution. Being at the time alone, he became alarmed lest he should have taken an overdose, and very soon his pulse rose to above 100 in a minute. The fulness in the head and constriction in the throat were, he thought, more marked than after the smaller dose. In a minute or two the pulse fell to 90, but the fulness in the head lasted some time, and was followed by a slight headache. To two medical friends Dr. Harley administered respectively twenty-eight and thirty-eight drops in divided doses without the production of any symptoms. Some pure nitro-glycerine was then obtained, and of this Dr. Harley took, in the course of a few



minutes, a drop, equivalent to a hundred drops of the solution previously employed. The only symptoms produced were a quickened pulse, fulness in the head, and some tightness in the throat; but as these passed off in a few minutes, Dr. Harley considered that they were probably the effects of "fear and imagination". On a subsequent occasion he took, in the course of three-quarters of an hour, a quantity of the nitro-glycerine solution equivalent to  $199\frac{1}{2}$  drops of the solution used by Mr. Field, with the production of no more disagreeable symptoms than those he had experienced in his former trials. The quickening of the heart's action he ascribed to fear, but the head and neck sensations were, he considered, "too constant to be attributed to the same cause", although he thought they were exaggerated by the imagination. Dr. Harley, in conclusion, states that he experimented on ten different gentlemen with nitro-glycerine solution, obtained from four different sources, without witnessing any dangerous effects when administered in the above doses; but he adds that, if taken pure, great caution should be used.

Dr. Fuller, whose observations were made in conjunction with Dr. Harley, commenced by taking two drops of a one per cent. solution. In the course of a minute he felt, or "fancied he felt", some fulness in the head, but was not conscious of any other unusual sensation. A little later he took one-sixth of a drop of pure nitro-glycerine, equivalent to about seventeen drops of the solution spoken of by Mr. Field. Two minutes later his pulse had risen to 96, and there was an increased fulness about the head, but without giddiness or confusion of thought. The pupils were not affected, and he did not experience any unusual sensation beyond that already mentioned. A quarter of an hour later he took a dose equal to  $33\frac{2}{3}$  drops of Mr. Field's solution, and a few minutes later another dose equivalent to 50 drops. He felt somewhat nervous, and for a few minutes the surface of the body was covered with a clammy perspiration; his pulse intermitted occasionally, and he experienced an increase of fulness about the head. Whether the acceleration of the pulse observed in the first instance was attributable to the effects of the drug he was unable to decide, but his own impression was that it was merely the result of nervousness and excitement; for, had it been otherwise, it is not likely, he says, "that the pulse would have fallen to its natural standard within so short a period after taking the larger doses". The fulness in the head might, he considered, have been attributed in part to the same cause, but a sense of discomfort in the head lasting some hours was, he thought, really due to the



drug. As the result of these observations, Dr. Fuller concluded that nitro-glycerine was incapable of producing the effects that had been ascribed to it, and that it might be taken with impunity in considerable quantity.

In a second communication to the same journal, Mr. Field reasserted the correctness of his observations, and maintained that a reasonable explanation of the very different results obtained by different observers might be found in the great variation in strength to which the drug is liable. He considered, too, that the conditions under which the drug was taken had much to do with its action. When the system is worn out by fatigue, he says, it is more likely to act powerfully than when taken under less unfavourable conditions. On the occasion of taking the dose which produced in him such startling effects, his nervous energy had been impaired by an unusually hard day's work. He found that under more favourable conditions he could take the same dose with the production of nothing worse than headache. Having in his experiments on himself experienced the greatest variation in the strength of different specimens of nitro-glycerine, he was disposed to think, on reading the account given by Dr. Fuller and Dr. Harley, that they had used a less powerful agent. He accordingly called on Dr. Fuller, and induced him to take a dose of the solution he had used, but to his surprise, he experienced little beyond headache. On the same day, Mr. Field administered to a hospital patient suffering from hemicrania two drops of the solution. In about a minute he became pallid, felt sick and giddy, his forehead was covered with perspiration, and he sank on the bed by which he was standing almost unconscious, his pulse failing so as scarcely to be felt. After the administration of a little ammonia the circulation became more vigorous, and in twenty minutes there was a marked diminution of the pain, and he experienced a great desire to sleep, a luxury of which his sufferings had almost deprived him on previous nights. Mr. Field administered small doses of the drug to several other people, all of whom were distinctly affected by it.

Mr. Field's observations respecting the activity of the drug were also confirmed by Mr. F. Augustus James, a student of University College. He took a single drop of the one per cent. solution. In the course of a few minutes he experienced a sensation as if he were intoxicated. This was quickly followed by a dull aching pain at the back of the head, which was alternately better and worse, each accession becoming more and more severe. It soon extended to the forehead and the back of the neck, in which there was a de-



cided feeling of stiffness. He also experienced some difficulty of deglutition, succeeded by nausea, retching, and flatulence. A profuse perspiration ensued, and in a quarter of an hour the symptoms began to abate, but he continued dull and heavy. His pulse, he found, had risen from 80 to 100. Considerable headache remained, which increased in the after part of the day, so that at six o'clock he was compelled to go to bed. At break of day he was not relieved, but after a few hours' more sleep he felt quite well again.

Mr. G. S. Brady, of Sutherland, obtained very decided results from the administration of large doses of nitro-glycerine to a lady suffering from severe facial neuralgia. He gave two minims and a half of Morson's five per cent. solution in a little water. In the course of two or three minutes she began to complain of sickness and faintness; these rapidly increased; there was for a few minutes unconsciousness, accompanied by convulsive action of the muscles of the face, and stertorous breathing. After swallowing some brandy-and-water, she vomited, and the unpleasant symptoms gradually subsided. Mr. Brady also mentions the case of a relative of his, a chemist, who took a drop of the five per cent. solution in water. Shortly afterwards a feeling of sickness and pain at the epigastrium came on, and he left his desk to pace about the shop, thinking to walk off the uncomfortable sensations. Instead of this they grew worse, and an intolerable sense of oppression and swimming in the head, with spasmodic twitching of the limbs, supervened. He had barely time to call his assistant when he fell back insensible. Cold water was freely dashed over the face, and the unconsciousness soon passed away. No vomiting ensued, but the sensation of sickness lasted for some time.

Being greatly interested in this curious controversy, and being quite at a loss to reconcile the conflicting statements of the different observers, or arrive at any conclusion respecting the properties of the drug, I determined to try its action on myself. Accordingly I obtained some one per cent. solution. One afternoon, whilst seeing out-patients, I remembered that I had the bottle in my pocket. Wishing to taste it, I applied the moistened cork to my tongue, and a moment after, a patient coming in, I had forgotten all about it. Not for long, however, for I had not asked my patient half a dozen questions before I experienced a violent pulsation in my head, and Mr. Field's observations rose considerably in my estimation. The pulsation rapidly increased, and soon became so severe that each beat of the heart seemed to shake my whole body. I regretted that I had not taken a



more opportune moment of trying my experiments, and was afraid the patient would notice my distress, and think that I was either ill or intoxicated. I was quite unable to continue my questions, and it was as much as I could do to tell him to go behind the screen and undress, so that his chest might be examined. Being temporarily free from observation, I took my pulse, and found that it was much fuller than natural, and considerably over 100. The pulsation was tremendous, and I could feel the beating to the very tips of my fingers. The pen I was holding was violently jerked with every beat of the heart. There was a most distressing sensation of fulness all over the body, and I felt as if I had been running violently. I remained quite quiet for four or five minutes, and the most distressing symptoms gradually subsided. I then rose to examine the patient, but the exertion of walking across the room intensified the pulsation. I hardly felt steady enough to perform percussion, and determined to confine my attention to auscultation. The act of bending down to listen caused such an intense beating in my head that it was almost unbearable, and each beat of the heart seemed to me to shake not only my head, but the patient's body too. On resuming my seat I felt better, and was soon able to go on with my work, though a splitting headache remained for the whole afternoon. Were my symptoms due to nervousness or anxiety? Certainly not. I will not say that I discredited Mr. Field's observations, but after Dr. Harley's positive assertions I certainly did not expect to obtain any very definite results from so small a dose. Moreover, at the moment of the onset of the symptoms I was engaged in the consideration of another subject, and had forgotten all about the nitroglycerine. I did nothing to intensify the symptoms, but, on the contrary, should have been only too glad to have got rid of them. The headache, I can most positively affirm, was anything but fancy. Since then I have taken the drug some thirty or forty times, but I never care to do so unless I am quite sure that I can sit down and remain quiet for a time, if necessary. It uniformly produces in me the same symptoms, but they are comparatively slight if I refrain from moving about or exertion of any kind. The acceleration of the pulse is very constant, although sometimes it amounts to not more than ten beats in the minute. The temperature remains unaffected. The pulsation is often so severe as to be acutely painful. It jerks the whole body so that a book held in the hand is seen to move quite distinctly at each beat of the heart. The amount of pulsation may be roughly measured by holding a looking-glass in the hand and throwing the re-



flection into a dark corner of the room. Before taking the drug the bright spot may be kept steady, but as soon as the pulsation begins it is jerked violently from side to side. I have taken all doses from one minim to ten, sometimes simply dropped on the tongue, at others swallowed on sugar or in water. I have not ventured to take more than fifteen minims in a quarter of an hour. Once or twice a ten-minim dose has produced less pulsation than I have experienced at other times from a single drop; but then with the larger quantity one is careful to avoid even the slightest movement. After a five-minim dose I usually experience a certain amount of drowsiness—a lazy contented feel, with a strong disinclination to do anything.

Thinking there might be individual differences of susceptibility to the action of nitro-glycerine, I have laid my friends and others under contribution, and have induced as many as possible to give it a trial. I have notes of thirty-five people to whom I have administered it—twelve males and twenty-three females; their ages varying from twelve to fifty-eight. I find they suffered from much the same symptoms as I did, although it affects some people much more than others. Of the number above quoted, only nine took minim doses without experiencing decided symptoms. Women, and those below par, are much more susceptible to its action than are the strong and robust. A delicate young lady, to whom, adopting Mr. Field's suggestion, I administered it in drop doses for the relief of neuralgia, experienced very decided effects from it, each dose producing a violent headache lasting from half an hour to three hours. A married woman, aged thirty-five, took one minim with very little inconvenience, but was powerfully affected by two. She was obliged to sit down after each dose, and was positively afraid to move. It made her hot, and caused such a beating in her head that she had to support it with her hands. She experienced a heavy weight on the top of the head, and also a sharp darting pain across the forehead, which for a moment or two was very painful to bear. A friend, who for some days took four drops every three or four hours, informs me that at times it affected his head "most strangely". The pulsation was very distressing, and often lasted an hour or more, being intensified by moving. It has relieved him of an old-standing facial neuralgia, and he is enthusiastic in its praise. A young woman, aged 29, complained that after every dose of the medicine—one minim—"it seemed as if the top of her head were being lifted off", and this continued sometimes for five minutes, and sometimes longer. The medicine made her bewildered, and



she felt sick. A patient with a faint apex systolic murmur was ordered one minim in half an ounce of water four times a day. He took two doses, but it caused "such a beating, thumping, hot pain" in his head that he was unable to continue it. A young man who was given nitro-glycerine in mistake for phosphorus said it made his temples throb, and he could see his pulse beat so distinctly that he was frightened. It caused a burning and flushing in his face, and "took every bit of strength away". This would last for twenty minutes or half an hour after each dose. There was no headache. That alarming symptoms may be produced by large doses, is shown by the following case. A woman, aged 51, was ordered drop-doses of the one per cent. solution every four hours. This was taken well, and at the expiration of a week the dose was doubled. No complaint being made, it was then increased to four minims, and after a time to six. The patient said "the medicine agreed with her", and even leading questions failed to elicit any complaint of headache or the like. After the medicine had been taken continuously for five weeks the dose was increased to ten minims. The patient then stated that the medicine no longer agreed with her; it made her sick after every dose and took her appetite away. She always vomited about five minutes after taking the medicine, the vomiting being immediately followed by headache. The medicine made her "go off in a faint", after each dose. She had three "fainting fits" in one day, and could not venture to take another dose. She became quite insensible, and once remained so for ten minutes. Each fainting-fit was "followed by cold shivers", which "shook her violently all over". Her husband and friends were greatly alarmed, but she thought on the whole it had done her good. She had never noticed that the medicine produced drowsiness. In another case a three-minim dose taken on an empty stomach caused a feeling of faintness; "everything goes dark", the patient said, "just as if I were going to faint". The patient could take the same dose after meals without the production of any unpleasant symptom. Drowsiness is not an uncommon result of taking nitro-glycerine. A woman who was given drop-doses four times a-day said that she usually went fast asleep immediately after each dose, sleeping from three to four hours. In my own case the desire for sleep was almost irresistible, although the sleep seldom lasted more than an hour. In exceptional cases none of the ordinary symptoms are exhibited. A man with epispadias—to be presently mentioned—took twenty-five minims of the one per cent. solution without any inconvenience.



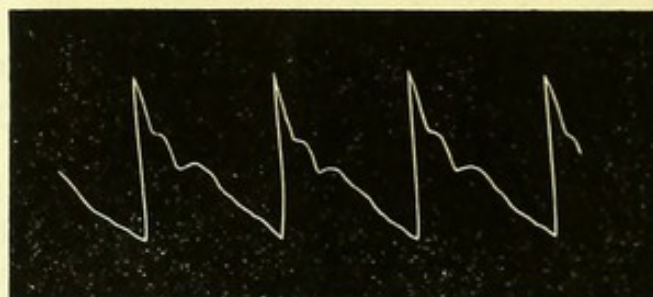
From a consideration of the physiological action of the drug, and more especially from the similarity existing between its general action and that of nitrite of amyl, I concluded that it would probably prove of service in the treatment of angina pectoris, and, I am happy to say, that this anticipation has been realised.

As a preliminary step I was anxious to obtain a comparative series of sphygmographic tracings, and for these I am indebted to the kindness and courtesy of Dr. Fancourt Barnes, whose extensive practical acquaintance with the sphygmograph is a guarantee of their accuracy. During the last three months Dr. Barnes has taken over 150 tracings of my pulse, some showing the influence of nitro-glycerine, in others of nitrite of amyl. It would be tedious to describe the observations in detail, more especially as the tracings speak for themselves, and we consequently give only a summary of our results. Judged by the sphygmographic tracings, the effects of nitrite of amyl and of nitro-glycerine on the pulse are similar. Both drugs produce a marked state of diastole, and both accelerate the rapidity of the heart's action; they differ, however, in the time they respectively take to produce these effects. The full action of the nitro-glycerine is not observed in the sphygmographic tracings until six or seven minutes after the dose has been taken. In the case of nitrite of amyl the effect is obtained in from fifteen to twenty seconds after an inhalation or a dose has been taken on sugar. The influence of the nitrite of amyl is extremely transitory, a tracing taken a minute and a half after the exhibition of the drug being perfectly normal. In fact, the full effect of the nitrite of amyl on the pulse is not maintained for more than fifteen seconds. The nitro-glycerine produces its effects much more slowly; they last longer, and disappear gradually, the tracing not resuming its normal condition for nearly half an hour. The effect may be maintained for a much longer time by repeating the dose. Nitro-glycerine is more lasting in its power of producing a diastolic form of pulse-beat, and, consequently, in cases where the conditions of relaxation and diastole are desired to be maintained for some space of time, its exhibition is to be preferred to that of nitrite of amyl.

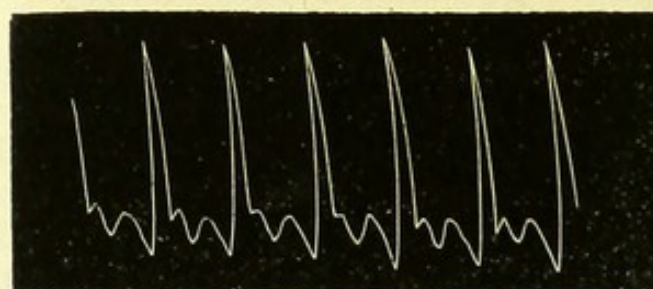
Whilst making some observations with nitro-glycerine on a patient suffering from epispadias, he called attention to the fact that the administration of the drug always caused an increased flow of urine. On examination, fifty-three minutes after the administration of a dose of twelve minims of the one per cent. solution, the urine was seen spouting from the



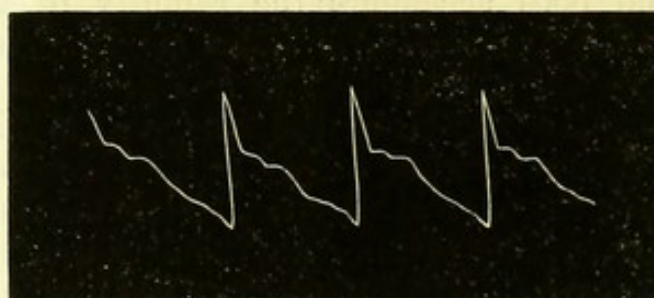
*Influence of Nitrite of Amyl on the Pulse.*



No. 1.—Before inhalation.

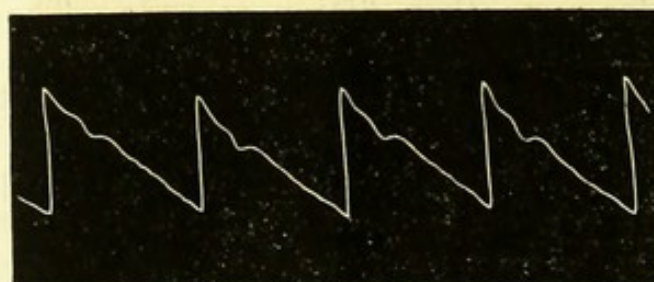


No. 2.—One minute after inhalation.

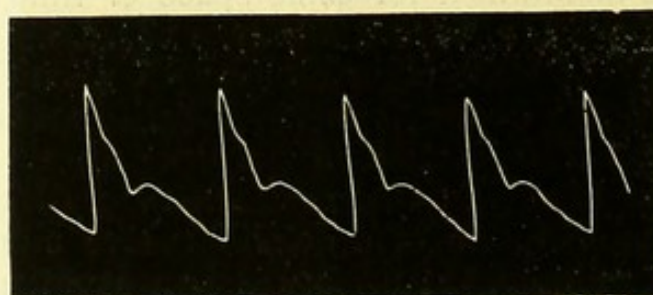


No. 3.—Two minutes after inhalation.

*Influence of Nitro-Glycerine on the Pulse.*

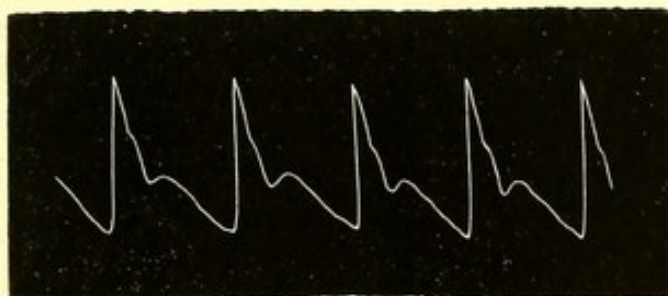


No. 1.—Before dose.

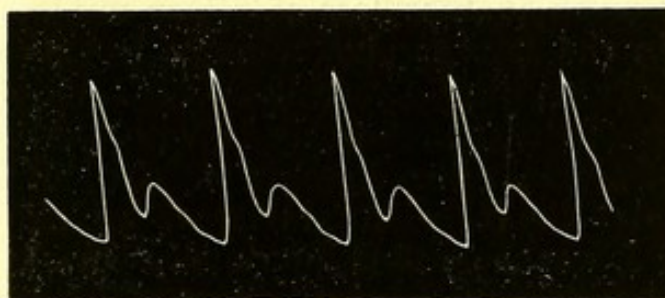


No. 2.—Two minutes after dose.

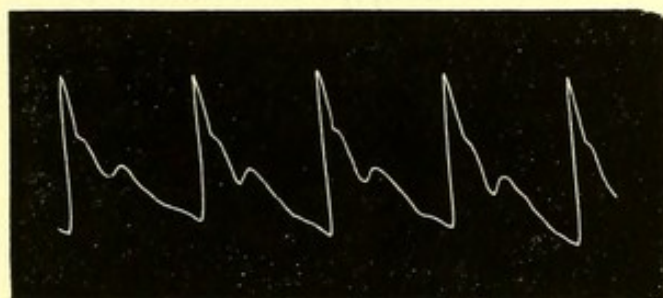




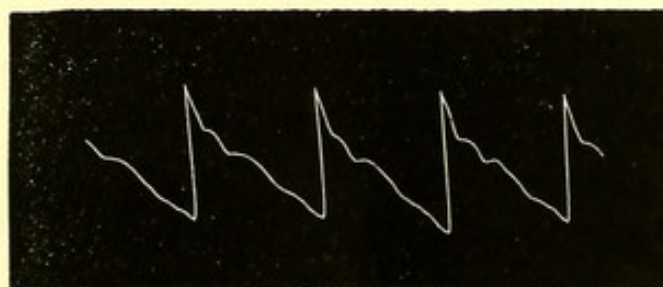
No. 3.—Eight minutes after dose.



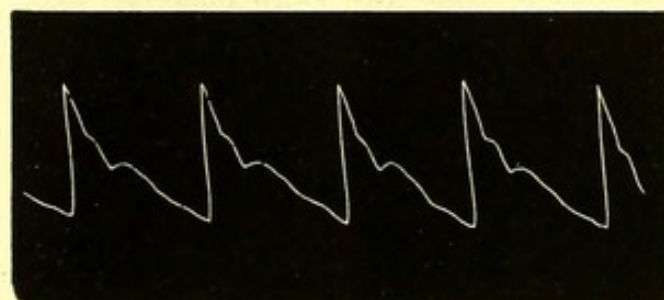
No. 4.—Nine minutes after dose.



No. 5.—Ten minutes after dose.



No. 6.—Twenty-two minutes after dose.



No. 7.—Twenty-six minutes after dose.



extremity of each ureter in a little jet some three or four inches high. Ordinarily the urine dribbles away drop by drop, and never spouts out. The patient was much amazed, and said that in the whole course of his life he had never known it go on in that way. If he took beer or spirits it would increase the flow, but this, to use his own expression, "licked everything". He was made to lie on his face, so that all the urine might be collected. In twelve minutes he secreted  $6\frac{3}{4}$  oz. of urine, the specific gravity of which was only 1000. He was then given another dose of fifteen minims in a little water, and in the next twelve minutes he secreted  $7\frac{3}{4}$  oz. Three days later, no nitro-glycerine having been given in the meantime, an observation was made with the view of determining the normal rate of secretion. In half an hour he secreted  $3\frac{1}{2}$  oz., the specific gravity of which was 1005. This, he stated, was more than he usually passed, for he had taken three-quarters of a pint of milk about two hours before, and "it was just running through him".

On another occasion a more systematic observation was made. His urine was collected every quarter of an hour for two hours, patient having had nothing to eat or drink for four hours previously. The quantities passed were as follows:—

1st quarter of an hour,	$2\frac{3}{4}$ drachms.
2nd     "                  "	$2\frac{3}{4}$ "

He was then given fifteen minims of the one per cent. nitro-glycerine solution in a drachm of water.

3rd quarter of an hour,	12 drachms.
4th     "                  "	16     "
5th     "                  "	$6\frac{3}{4}$ "
6th     "                  "	$8\frac{3}{4}$ "
7th     "                  "	$5\frac{3}{4}$ "
8th     "                  "	3     "

The times were accurately taken, and in no instance was any of the urine lost. The increased secretion was obviously due to the drug. It is noteworthy that the maximum increase was not till the second quarter. Every specimen was examined as it was passed, and they were all free from sugar and albumen. The quantity was too small to admit of the specific gravity being taken by the urinometer, except in the case of the fourth quarter, when it was found to be 1003. It should be mentioned that this patient was very insusceptible to the action of the drug, and he experienced none of the ordinary symptoms from this dose.

In another observation on the same patient the results were still more striking. The same method of collecting the



urine every quarter of an hour was adopted, and the following figures were obtained:—

	Sp. gr.	Pulse.
1st quarter of an hour, 4 dr. ....	—	64
2nd „ „ 10½ dr. ....	1003	64

Given twenty minims of one per cent. nitro-glycerine in one drachm of water.

	Sp. gr.	Pulse.
3rd quarter of an hour, 7 oz. ....	1000	80
4th „ „ 7½ oz. ....	1000	76
5th „ „ 1 oz. ....	1002	72
6th „ „ 7 dr. ....	—	68
7th „ „ 4½ dr. ....	—	64

The acidity of the urine varied inversely as the quantity passed. Thus, before the administration of the drug, it was distinctly acid, during the third and fourth quarters it was almost neutral, the acidity then gradually returned, till, in the seventh quarter, it was as marked as it had been at first. No sugar or albumen was detected either before or after the administration of the drug. The figures given under the head of pulse are averages of several observations made during each quarter of an hour. No subjective symptoms of any kind were produced. The experiment was commenced at ten in the morning, and patient had had nothing to eat or drink since breakfast at six. This epispiadiac man was curiously insusceptible to the action of the drug as far as subjective symptoms were concerned. I gave him the one per cent. nitro-glycerine solution on ten different occasions, in doses of 3, 4, 4, 6, 12, 15, 15, 20, and 25 minims, without causing him a moment's pain or uneasiness. He never complained of headache, or beating or throbbing in any way, and yet the influence, both on the pulse and on the secretion of the urine, was well marked. Even the small doses affected the rate of his pulse. Thus, on one occasion, his pulse was taken every minute for eleven minutes, the average being 68. He was then given a little water in a medicine glass—a practice always followed in these observations—to test the effects of expectation. The pulse remained constant at 68 during the next five minutes, and six minims of the one per cent. solution were then given in water. In a minute and a half the pulse had risen to 76, and this increased rate was maintained for the next fifteen minutes, when it sank again to normal. On another occasion his pulse, taken on ten consecutive minutes, was found to be 80. He was then given twenty minims of the one per cent. solution in water. Half a minute after the pulse was still 80, in one and a half



minutes after it was 96, and in two and a half minutes after it was 100, the average of the eight minutes following the administration of the drug being 96.

Such were the results of the ten series of observations on this man—negative as regards his own sensations. As a final experiment it was decided that he should take a larger dose. At 11.51 A.M., sitting still in the cool laboratory, and having had nothing since an early breakfast, his pulse was 76. At 11.55 min. 30 sec. he took half a drachm of the one per cent. solution in a little water. At 11.56, pulse 76; at 11.57, 92; at 11.58, 96, soft and regular. At 12.4 he commenced yawning violently, and said he felt very sleepy. At 12.7 the pulse fell to 68, the yawning ceased, and he became very pale and complained of nausea. He was found to be perspiring freely all over the body, and was so hot that he kicked off his boots. The nausea lasted till 12.10, when the colour had returned to his face, and he said he felt all right again; pulse 76 to 80. There was no headache, and even a sharp run upstairs failed to produce any feeling of pulsation.

During the last nine months I have treated three cases of undoubted angina pectoris with nitro-glycerine, with what success the cases themselves will show.

William A——, aged sixty-four, first came under observation in December 1877, complaining of intense pain in the chest, excited by the slightest exertion. It was distinctly paroxysmal, patient being perfectly well in the intervals. The first attack was experienced in September 1876. Patient was at the time in his usual health, and was, in fact, out for a day's pleasure in the country. The pain seized him quite suddenly when walking. It was a most severe attack—as severe a one as ever he experienced in his life. It caused both him and his friends great alarm, and they were most anxious that he should return home at once. He cannot tell at all what brought it on; he had been enjoying himself very quietly; it was not by any means a cold day, and he had not been running, or even walking faster than usual. He remained perfectly well until the following April, when he experienced another similar attack; and since then he has been suffering from them with increasing frequency. From September 1877, they have been a source of constant anxiety, and it was only by a determined effort that he could continue to follow his occupation.

The attacks usually commence with a feeling of warmth, then of heat, and then of burning heat, in the chest, immediately followed by a heavy pressure, from the midst of



which proceeds an acute pain, so that in a moment the whole chest seems as if it were one mass of pain. It is almost impossible, he says, to describe it, for he never felt anything like it before. The pain is first experienced at a small spot on either side of the sternum, corresponding to its junction with the fourth costal cartilages. From the chest the pain flies to the inner side of the arm, at a point midway between the shoulder and the elbow. It runs down as far as the elbow, but never to the fingers. It is not more severe on one side than the other. During the seizure the patient suffers most acutely, and feels convinced that some day he will die in an attack. He usually experiences some shortness of breath at the time, but there is no feeling of constriction about the chest. He can speak during the seizure, though with some difficulty. The attacks are not accompanied by any sensation of warmth or chilliness, but patient is under the impression that he grows pale at the time. These attacks are induced only by exertion in some form or other, most commonly by walking, and especially by walking fast. Walking up hill is sure to bring on a seizure. Stooping down has a similar effect, and the act of pulling on the boots will excite a paroxysm almost to a certainty. He is almost afraid to stoop down, and when he wants to pick up anything from the floor he goes down on his hands and knees. He has a slight cough, but although it shakes him at times it never brings on the pain. The attacks are not excited by food, but exercise taken after meals is more likely to induce them than when taken on an empty stomach. Patient has noticed that they are far more readily excited immediately after breakfast than at any other period of the day. They are more readily induced, too, after an indigestible meal than at other times, but patient is quite clear that no amount of indigestible food *per se* will bring on an attack. The paroxysms, as a rule, last only three or four minutes, but occasionally from twenty minutes to half an hour. If they come on whilst he is walking they always continue till he stops. Patient finds that stimulants afford no relief. In the intervals between the attacks patient is perfectly well, and he feels that if he could only remain absolutely quiet the whole day long he would be quite free from pain. Practically, as he is obliged to be out and about, he has several attacks, on an average six or eight every day. At the time of coming under observation the seizures were rapidly increasing both in frequency and severity. His family history was fairly good. His father died at the age of eighty-three, and hardly had a day's illness



in his life. His mother died of phthisis, but only, patient says, through catching cold, hers not being a consumptive family. He lost two brothers—one at the age of eighteen from consumption, and the other in the tropics, cause unknown. He has two brothers and one sister living, all well. There is no family history of gout, asthma, fits, heart disease, or sudden death. He has four children, one of whom (a boy) is consumptive, and another (a girl) subject to facial neuralgia. Patient is a bailiff by occupation, and is a remarkably intelligent man. He is a cool, clear-headed fellow, but little prone to talk of his sufferings, although they are at times very severe. He has travelled much, and has lived in Egypt, Turkey, Italy, and Greece. For the last thirty years he has been accustomed to lead an active out-door life, seldom walking less than fifteen miles a day, often very fast. He has, he says, done a great deal of hard work in the way of pleasure. He usually smokes about two ounces of bird's-eye in the week, and has done so for years. His health has always been remarkably good, and, with the exception of rheumatism ten or twelve years ago, and pleurisy seven years ago, he has never known what it is to be laid up. He has never suffered from gout. On a physical examination it is noticed that there is some fibroid degeneration of the arteries, and there is slight hypertrophy of the left ventricle. There are no signs of valvular disease, and there is nothing to indicate the existence of aneurism. The urine was free from albumen.

There could be no possibility of doubt respecting the diagnosis. It was a typical uncomplicated case of angina pectoris.

Patient was placed for a week on infusion of quassia, in order that he might be observed, and also to eliminate the effects of expectation. It need hardly be said that he derived no benefit from this treatment. He was then ordered drop-doses of the one per cent. nitro-glycerine solution in half an ounce of water three times a day. At the expiration of a week he reported that there had been a very great improvement. The attacks had been considerably reduced in frequency, and, for two or three days he had had only one attack—in the morning after breakfast. The attacks, when they did occur, were much less severe. He found, too, that a dose of medicine taken during an attack would cut it short. He had tried it several times, and it had always succeeded. It would not act instantly, but still very quickly; so that the attacks were considerably shortened. He was thoroughly



convinced that the medicine had done him good, and said he was better than he had been since first he had the attacks. It was found that the nitro-glycerine, even in this small dose, had produced its physiological action. Patient complained that for two or three days he had experienced a strange fulness in his head, with a sense of pulsation. The pulsation was felt chiefly in the temples, but also across the forehead. It caused him no positive inconvenience, and he evidently had no suspicion that it was due to the medicine. The dose was then increased to three minims, and patient found that this gave him more speedy relief. On two days during the week he had no seizure at all—a most unusual circumstance. Patient had adopted the plan of carrying his medicine with him in a phial, and taking a dose if an attack seized him in the street. It never failed to afford relief. The beating had increased considerably in intensity, and was described as being a “kind of a pulse”. Patient had discovered the fact that it was produced by the medicine. It came on immediately after each dose, and lasted about a quarter of an hour. It was now experienced chiefly across the forehead. Patient continued steadily to improve, and the dose was gradually and cautiously increased. With the increase in dose the pulsation became more severe, lasting from twenty minutes to half an hour. When twelve minims were given every three hours it became a positive inconvenience.

On January 14th the dose of the nitro-glycerine solution was increased to fifteen minims every three hours. A few days later he had a “kind of fit” immediately after having his medicine. The pulsation came on as usual, but was quickly followed by headache and pain at the back of the neck. His speech “began to go off”, and he felt that he would have lost his senses had they not given him tea and brandy.

Patient took the fifteen-minim dose every three hours from the 14th to the 28th of January, but on the latter date had two “bad shocks”. He took a dose of medicine in the morning as usual, and felt the customary pulsation, which passed off after about half an hour. An hour and a half later he experienced a sensation as if he would lose his senses. He did not fall, but had to catch hold of something to prevent himself from so doing. It did not last more than half a minute, and there was no pulsation with it. The other seizure occurred later in the day, and was of the same nature. Patient attributed these attacks to the medicine, and was in no way alarmed by them. He thought it advisable,



however, to reduce the dose by a third, and henceforth had no return of the fits. At this time his anginal attacks were so thoroughly kept in check by the nitro-glycerine that they gave him comparatively little inconvenience. He always carried his bottle of medicine with him, and immediately on experiencing the slightest threatening of an attack he took a sip. Relief was certain, for even when it did not at once cut short the attack it eased the pain so considerably that he was able to go on walking. For two months longer he continued the ten-minim dose, sometimes taking a little more, and sometimes a little less. He preferred taking it occasionally, as he thought it might be necessary to take it regularly. For the last eight months he has taken nothing but cod-liver oil, and sometimes tonics, and has not had a single attack. He attends once or twice a month, but is perfectly well. He can walk and get about as well as ever he could.

The second case was that of Mrs. H. S.—aged 53, who first came under observation in January 1878. She is a married woman and the mother of eight children. She complained of a “strange sensation” in her chest, over her heart, coming on in fits several times a day. It was not a pain, she said, at least not an ordinary pain; it was something more than that—it was “just as if the life were going out of her”. The attacks would last only two or three minutes at a time, but she seemed as if she could not get her breath, and they frightened her. She could just say “Oh dear!” or something like that, but nothing more. She would usually put her hand over her heart and press hard, and that seemed to relieve her. She feels quite cold during an attack, and her friends tell her she gets pale in the face. The sensation is referred to a spot corresponding in situation to the point of maximum intensity of the heart’s beat. It always keeps in the same place, and never flies to the shoulders or runs down the arms. In the intervals of the seizure she is perfectly well. There is no flatulence, nausea, vomiting, numbness in the arms, or vertigo, and the attacks are not followed by any discharge of urine. Patient never has an attack when quiet. The slightest exertion will bring one on: going upstairs will always do so, and even if she goes up very slowly she is sure to get an attack. She does not often get them on level ground, unless walking fast, and then she gets them. Going up-hill brings them on much more readily than walking on level ground. She can always tell, she says, when the ground is rising; she knows directly. Shaking up a bed will bring on the pain at once. She dare not do it



now, and that is a great bother to her. Any little exertion is enough, as, for example, putting on her jacket or reaching up to the clothes line. Stooping down to lift anything brings them on, but not simply stooping down, as in pulling on her boots. Leaning back is certain to bring them on; the least excitement will do so—in fact, anything that worries or upsets her. They are not in any way influenced by food. Cold feet will not bring them on, nor will a hot room. These attacks commenced at the beginning of last summer (1877), but were not so bad as they are now. They worried her a good deal, lasted on and off for two or three months, and then went away. She cannot tell at all what brought them on. They returned on the following November, and have been getting worse ever since. Now she usually has seven or eight attacks a day, but the number depends very much on what she has to do. For some time past they have been gradually increasing in frequency, and are now far more readily excited than formerly. Her general health is fairly good. She has had a bad cough every winter for the last eighteen years. What with the cough and the children, she has never been very strong. She has never suffered from gout or anything like it. Patient's father died of gout and bronchitis. He had suffered from gout since he was twenty-one, and had large chalk stones. He was addicted to drink all his life more or less. His father and brother died of asthma. Patient's mother died in confinement, and she has no brothers or sisters. She lost one of her children from bronchitis and another from consumption. None of them ever had fits or St. Vitus's dance. On a physical examination, marked arterial degeneration is noticed. There is slight emphysema. There are no signs of aneurism and none of valvular mischief. Urine normal.

Here, again, little doubt was entertained respecting the diagnosis. It was not a typical case of angina pectoris perhaps, but it assimilated more closely to that type of disease than to any other. There could be no doubt about the reality of the patient's sufferings.

After a preliminary course of camphor-water, the patient commenced taking the nitro-glycerine on February 4th. She was ordered one drop of the one per cent. solution in half an ounce of water every four hours. In three days she reported that the pains had occurred less frequently; that they did not last so long. The pains were much shorter, and "there was a good bit of difference". She complained that the medicine had given her "such a strange sensation". It gave



her "a kind of pain inside her head," and brought on a throbbing across her forehead just where the hair begins. After each dose she felt powerless for about ten minutes, and had to sit down, feeling that she could not do anything. The dose was then increased to four minims every four hours, and this gave very marked relief to the anginal symptoms. The pains, she said, were very much better, and a dose of the medicine would always cut them short, almost at once; they were less frequent, less severe, and did not last so long. She was no longer afraid to hurry about the house, and was able to perform many little household duties that had been long neglected. She spoke very positively as to the good the medicine was doing her, but at the same time complained that it affected her most powerfully. The throbbing in her head after the dose was very strong, and lasted nearly twenty minutes; it was accompanied by a darting pain, and she felt cold all over; she had to sit down, and could do nothing as long as it lasted.

The patient continued to improve, and on February 21st she said she had taken a long walk the day before, not only without difficulty, but with pleasure. Under ordinary circumstances the exertion would have brought on an attack, and she would probably have had to return home. The attacks are now experienced only once or twice a day, in spite of her getting about much more; and they are very much slighter than formerly, not lasting half the time. She does not take much notice of them now, and no longer has to stop and put her hand over her heart. Some days she is entirely free from them.

Curiously enough, although the dose of the nitro-glycerine had been gradually increased to ten minims every four hours, the patient complained less of the throbbing in the head. During the following week the dose was increased, first to fifteen and then to twenty minims every four hours. The effect of the larger dose was very marked. She said the medicine made her "feel very bad"; she was afraid of it, for she felt it to her very fingers' ends. She throbbed all over—fingers, toes, and all. It affected her powerfully, and she had to sit down on the bed for nearly three-quarters of an hour after each dose. It caused noises in her ears just like the rushing of water, and made her feel cold all over. Sometimes it produced curious fits of gaping; she went on yawning and yawning, and seemed as if she would never stop. It never made her feel faint, and when it was over she felt quite well again.



The dose of the medicine was now gradually diminished, and on March 7th it was abandoned in favour of general tonics. The patient is still under observation, and, although she has slight attacks occasionally, they give her very little trouble. For the last eight months she has not had a single bad attack of pain.

R. A——, aged 61, a painter's labourer, was first seen on April 11th, 1878. Complains of a pain in the chest, which comes on when he walks. The pain is referred to the mid-sternal region, and is said to cover an area about the size of a teacup. It is a dull, heavy, tight pain. It begins in the chest, and then passes through to between the shoulders. During severe attacks it sometimes runs down the left arm as far as the elbow; it never extends to the lower extremities. It is excited by exertion, and chiefly by walking. It comes on suddenly, and he is obliged to stop and wait till it goes off. He may have to stop for a minute or two, or even longer. It often returns when he starts again. When walking it may come on several times in the course of half an hour, until at last it brings him to a full stop. If he walks fast it will bring it on, and so will going up hill. His ordinary work does not excite it, nor does stooping. He gets it chiefly morning and night, going to and returning from work. Has not noticed that it is more readily induced after meals, and does not think that food influences it in any way. When pain comes on he gets pale—so his friends tell him. Does not feel anxious, and the attacks do not frighten him at all. They are not accompanied by palpitation, but, during the attack, "he feels very full", "as if he must burst", or "as if his chest wanted moving". Patient has "knocked about a bit in his time", but has been "fairly steady". First he was on a farm, then in the police, then a wheelwright, and now he is a painter's labourer. When in the police he was advised to resign on account of weakness of his chest, but does not think his chest was really affected, for he had no cough, and has always felt well and strong. Is subject to gout, and had his first attack about three years ago. No history of syphilis. Has been a great smoker for the last forty years; used to smoke an ounce or more nearly every night, especially when on night duty, and it was always shag tobacco, and the strongest he could get. He experienced his first attack twelve years ago, when working on the Thames Embankment. It was the same kind of pain as he has now, but it went off in a week or two. A year later he had a return of it, which lasted for a few weeks. Eight years ago



a fire broke out, and he ran a mile and a half to fetch the engines. This brought on the attacks again, and he has had them more or less ever since. He has been getting worse during the last year, and especially during the last few months. On a physical examination, it was found that the pulse was irregular both in force and rhythm. There was some arterial degeneration, and a slight arcus senilis was noticed. No organic disease of the heart or lungs could be detected, and there were no signs of aneurism. Patient had a peculiarly anxious look, which was very noticeable. No albumen in the urine.

After a short course of camphor-water, patient was ordered a drop of the one per cent. solution of nitro-glycerine in half an ounce of water, to be taken every four hours. Four days later the patient reported that there had been a great improvement. The attacks were much less frequent, and that morning he had walked to his work without having a single seizure—a thing he had not done before for he could not say how long. The attacks at night going home were just as frequent, and he did not think they were less severe when they did come on. He had never taken a dose of the medicine when the attack was on him, so he could not say if it would cut it short. After each dose of the medicine he gets a pain at the back of the head, which comes on in about ten minutes and lasts half an hour. Says it is almost the same kind of pain as he has in his chest—"a heavy dull pain"; no beating or throbbing; no pain across the forehead or at the top of the head. Sometimes gets a "choky sensation in the throat" after the medicine. A few days later patient called again, and stated that he was steadily improving. At this visit he was given a single dose of two drops of the one per cent. solution on a piece of sugar. It produced slight flushing of the face and a marked increase in the fulness of the arteries. The pulse, which had previously been 98, rapidly rose to 112. The flushing was in a few minutes followed by intense pallor, and patient complained of feeling faint. He had to be supported to the sofa, his pulse was found to be very feeble, and it was a quarter of an hour or more before he was sufficiently recovered to stand alone. The patient was directed to continue the one-drop dose every four hours, and to take an extra dose when he felt the pain coming on. A week later he said he thought he was nearly well. For four days he had not had a single attack, although he had had a great deal of walking to do. When he felt any indication of the onset of the pain, he took a sip of his medicine,



and it was all gone in a moment. He could walk to his work without the slightest difficulty, and even coming home at night gave him no trouble. The other day he walked the best part of a mile in a shower of rain quite briskly, and was none the worse for it. After each dose he experiences a pain at the back of the head and also over the forehead. A week later the dose was increased to two minims every four hours, and this was taken without difficulty. The medicine, he said, did not upset him at all. It had done him a deal of good, and he did not know what he should do without it. The dose was gradually and cautiously increased to eight minims every four hours. This was taken without difficulty, patient remarking that it did not upset him as it used to do. He was quite free from the attacks as long as he continued taking the medicine, but they returned immediately he discontinued it. He still attends at long intervals to report himself, but is practically well.

In the following case, of which an abstract of the notes is given, the administration of nitro-glycerine was attended with success.

L. B——, soap-maker, aged 42. Complains of pain in the chest on the left side, constant, but increased by movement, very severe at times, and occasionally so acute as to make him cry out; seems as if it would take his breath away; sometimes occurs between the shoulders as well, and not unfrequently runs down the left arm as far as the elbow. If walking, and the pain comes on, he has to stop, but only for a few seconds, and then goes on again. The pain is increased by stooping down, as in putting on his boots. Any movement, even turning in bed, will bring on the acute pain; but still he is never entirely free from it. He has it more or less all day, and acutely on moving. He has the very greatest difficulty in doing his work. Has been abstemious all his life; a smoker, but not consuming more than half an ounce of tobacco a week. Has had gout thirty times or more during the last twelve years. Has had winter cough for about the same time. Never had these pains until this year. Has been gradually losing flesh for some months past. Physical signs those of emphysema; heart normal; no albumen in the urine. The patient was ordered a gentian-and-soda mixture, and this he took for a fortnight without the slightest benefit. The medicine, he said, did him more harm than good. The local application of belladonna failed to afford relief. He was then given drop doses of the one per cent. nitro-glycerine solution in half an ounce of water four times



a day. A week later he reported that he had felt relief on the first day, and had steadily improved ever since. He could stoop down without getting the old attacks, and could walk about almost as well as ever. He had not the slightest difficulty in taking the medicine. He remained under observation for some time longer, but there was no return of the pain.

In conclusion, I have to thank Dr. Ringer for his kindness in having frequently examined these patients, and also for many valuable suggestions.







