

**On the speedy relief of pain and other nervous affections, by means of the hypodermic method / by Charles Hunter.**

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ON THE

**SPEEDY RELIEF OF PAIN**

AND OTHER

**NERVOUS AFFECTIONS,**

BY MEANS OF THE

**HYPODERMIC METHOD.**

BY

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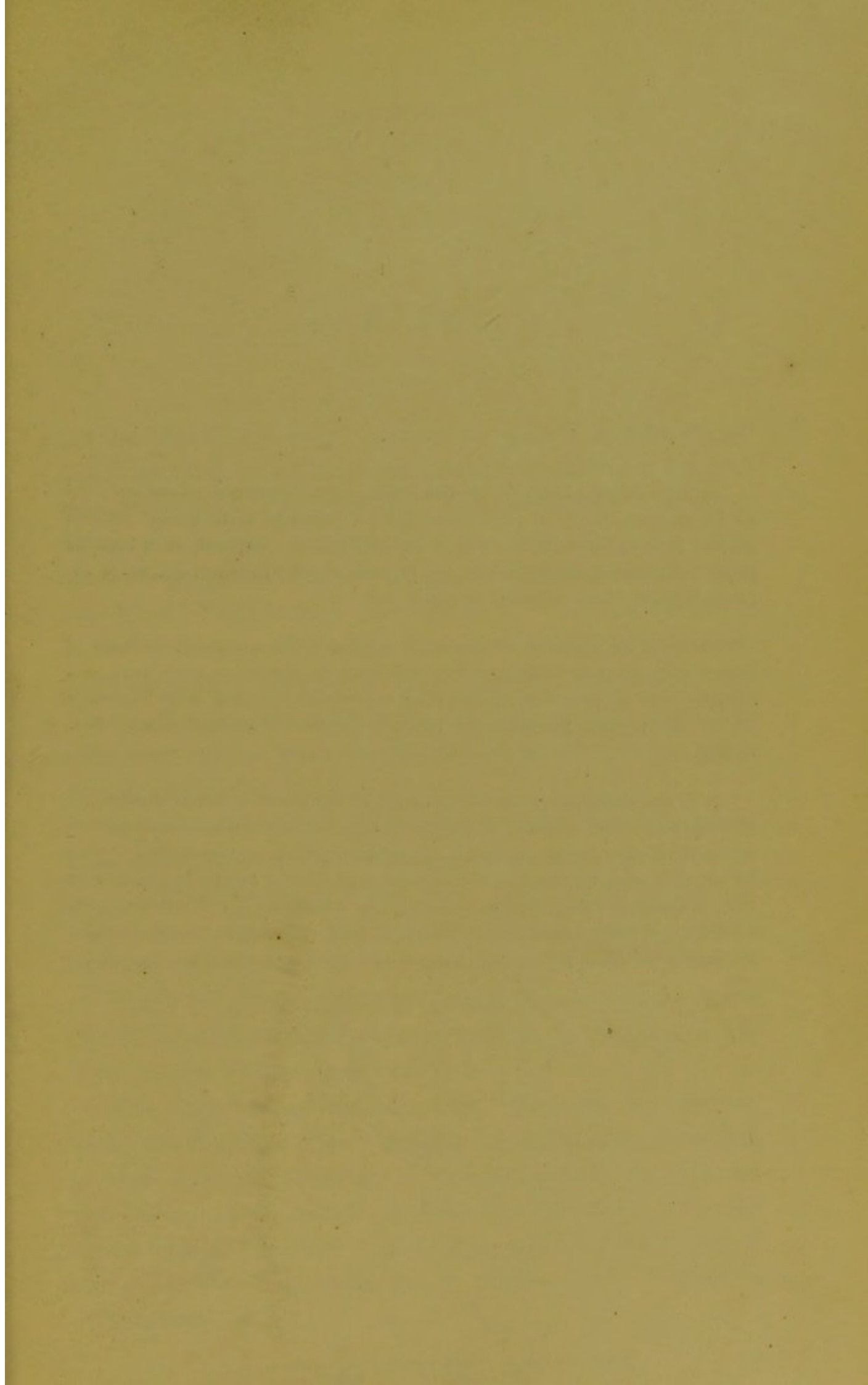
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"Je pense même, à raison de ces circonstances, que l'absorption sous-cutanée, qui n'a été employée jusqu'ici sur l'homme que par exception, devra devenir méthode générale pour l'administration de tous les médicaments énergiques, et à l'état de pureté."—Recherches Expérimentales sur l'Opium et ses Alcaloides; par M. le Dr. Claude Bernard, 'Arch. Générales de Med.,' 1864.

"One action of a remedy discovered, or applied to the successful treatment of disease, with an understanding of how the result is obtained, is worth more, in a scientific point of view, than all the lucky hits which a man may make in a whole lifetime of successful practice."—Dr. Barclay's Introductory Address, 'Lancet,' Nov. 15, 1862.

"As by this method we get the **WHOLE EFFECT OF THE KNOWN QUANTITY INTRODUCED**, which we are not sure of getting by the other modes, we have now a means, as accurate as that of venous injection (without its dangers), for testing the precise effect of little known medicines on animals; and the exact doses and effects of well-known medicines on man; of noting the difference which the sex requires in the dose; and of ascertaining the minimum amount required to produce a desired effect."—The Author, "On the Hypodermic Treatment," *MEDICAL TIMES AND GAZETTE*, 1859, p. 555, and p. 46 of this Pamphlet.

## PREFACE.

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ON the 23rd of last May, a paper of mine was read at the Royal Medical and Chirurgical Society upon the subject of this pamphlet. The President, in opening the discussion, did me the honour to say, that the object of the paper "was one of very great interest; so great, that the Council had appointed a Committee to investigate it." \* The conclusions of that Committee have not yet been arrived at; pending their decision, I venture to hope that the contents of the following pages, may conduce more fully to explain my views upon this subject, than the limited scope of a single paper would permit of.

Should another apology be requisite for the appearance of these pages, it is, that in them are embodied my replies to the majority of inquiries that have been made of me *per literas*, from time to time; and which I cannot always find time to reply to.

In the following pages the treatment of diseases, more especially of the central nervous system, by means of the Hypodermic Method, is discussed.

The Hypodermic Method (from 'Υπὸ, *sub*, and Δερμα, *cutis*), was the name I gave this plan of introducing medicines in 1859, to imply treatment carried on under, or *beneath*, the true skin. I so named it that the phraseology should accord with that already existing of *enepidermic*, or treatment carried on *above*; and *endermic*, by means of, the *cutis vera*, or true skin itself.

\* *Medical Times and Gazette*, June 3, 1865.



The First Two Chapters constitute a paper read by the author before the Western Medical and Surgical Society, on the 5th of May of this year. The paper was published in the July and August numbers of the *Medical Mirror*.

The Three following Chapters enter more minutely into the action of medicines when thus subcutaneously injected. They treat chiefly of atropine, which was first employed hypodermically by the author of these pages. The two first of these chapters appeared among the original communications to the *Lancet* in 1863.

The Sixth Chapter enters into a few practical points. It was written several years ago, and appeared in the *Medical Times and Gazette*. It constituted a reply to numerous correspondents, and will, it is hoped, equally answer in the present case.

In the Appendix are given two or three instances, showing in how marked and powerful a manner delirium and mania can be checked and cured by this treatment.

No infallibility is of course claimed for the hypodermic treatment. It is liable to failure like everything else. It may fail because the appropriate agent is not injected, or because the proper alkaloid is injected in too large or small a quantity, because the operator mismanages the method, &c.

Still, the Author believes the specific effect of certain powerful medicines can often be produced upon the system by this plan with the smallest possible dose, with marked and immediate benefit, when the same medicines in larger and often-repeated doses, have failed to be of any benefit when otherwise administered.

30 WILTON PLACE, BELGRAVE SQUARE,  
September, 1865.

C. H.

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#### ERRATA.

- Page 13, line 9 from bottom, insert "*often*" before "deeply placed."  
" 39 " 16 from top, for "extreme" read "extra."  
" 50 " 2, for "*us*" read "*up*."  
" 54 " 15 from top, insert "delayed" before "belladonna."  
" 55 " 2, read "iatraleptically."  
" 62 for "Epilepsy 3," read "23."





# THE HYPODERMIC TREATMENT OF DISEASE.

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## CHAPTER I.

*Gives the History of the Origin of the Hypodermic Treatment and shows how the Author's Method differs both Theoretically and Practically from the Local Practice of Dr. Wood.—The Value of this Treatment for Centric Affections of the Nervous System is shown.—With Cases and Deductions.*

A LITTLE more than six years ago (April, 1859), I had the honour to read before the Western Medical and Surgical Society, a short paper entitled "Experiments Relative to the Hypodermic Treatment of Disease."\* Those experiments were chiefly made upon animals with morphia, strychnia, and antimony. Their object was to test, comparatively, the relative value of the stomachic and hypodermic modes of medication; and the result appeared considerably in favour of the latter plan as regards rapidity and value of effect.

At that time no medicine had ever been injected beneath the skin, except with a *local object* in view; as in the treatment of nævi by caustics, and of neuralgia by opiate anodynes.

My experiments in 1858 were the first to upset the previously maintained theory, that—to produce a full medicinal effect upon any given nerve or locality, the medicinal injection should be into that locality itself.

As evidence opposed to that view, two cases of neuralgia were given by me, in which as much medicinal benefit followed the adoption of my method as had previously followed the use of the method of Wood; and without being accompanied by the disadvantages, which must, under certain circumstances,

\* The conclusion from the experiments on animals with hypodermic injections showed:—1. That they acted by absorption. 2. That they acted quicker than the endermic method, or than stomachic doses. 3. That they acted more effectually. 4. That a small injected dose was equivalent to a much larger one by the stomach.—*Medical Times and Gazette*, April 23rd, 1859.



attend the use of Dr. Wood's plan. So long ago as November, 1843, the injection of morphia had been used by Dr. Alexander Wood, of Edinburgh, and since that date it seems to have been extensively practised by him and his disciples, upon the principle laid down by him in that year.\* His instrument was made by Fergusson, of Giltspur street. The diseases for which he used it were neuralgia and local pain; the agent was morphia; and his theory was that of localization to the neuralgic site.

"I would impress upon you,"† said Dr. Wood in 1858, "that the instrument is not to be put into the place where the patient complains of the pain, but into the spot where you find you can awaken the pain upon pressure."

Employed upon this theory, it seems that in 1858, the use of the instrument had become "nearly universal," for the treatment of neuralgia, in Edinburgh. The evils chiefly dreaded, were gastric disturbance with vomiting, and excessive narcotism.‡ Nepenthe seems to have produced less sickness in the hands of Dr. Wood than opium or morphia, but no one of these agents was found to be infallible.

For fifteen years—namely, from 1843 to 1858, the *local* injection of Wood seems to have been more and more employed in Scotland, but it was little, if at all known or used in this metropolis. It is right to state here, that Mr. Rynd, of Dublin, claims priority in this matter. "The subcutaneous injection," says he, "of medicinal substances, to combat neuralgia, was first used by myself in Meath Hospital in May, 1844."§ The *Bulletin Thérapeutique* for 1861 says that Mr. Rynd employed a solution of ten grains of morphia in a drachm of *creosote* for his neuralgic and sciatic cases, a compound I should be very sorry to inject beneath the skin of any individual.

His instrument was, I believe, a clumsy one for this purpose, as a lancet had to be used, before inserting the point of the syringe. The syringe for injecting nævi and hæmorrhoids, which Dr. Wood employed, was I suspect, inferior in construction to the one I now use, for he states that he thought it best to dissolve his morphia in sherry-wine, rather than in water, lest the latter should rust the instrument.

The syringe which I am in the habit of using for injections will not rust; it is a modification of one introduced by Messrs. Savigne in 1857 (and described in the *Illustrated Exhibitor* of 1858). The tip of the pipe is finely pointed, and made of

\* Dr. Sieveking says: "Dr. Kurzak, of Vienna, was, I believe, the first to employ the subcutaneous or hypodermic method which was then largely used by Dr. Wood, of Edinburgh."—"Clinical Remarks on Neuralgia," *Lancet*, 1861.

† *British Medical Journal*, August 28th, 1858.

‡ *Loc. cit.*

§ *Dublin Medical Press*, March, 1845. Ranking's Abstract, 1845.



*hardened* gold, in which two particulars it differs from the French one invented a year or two before. In October, 1859, I had the barrel of the original syringe enlarged to hold thirty minims, the screw more carefully regulated, and the glass barrel graduated.

In 1858, the plan of Wood was first used in St. George's Hospital, Dr. Pitman having kindly consented to let me try it upon a man (T. G.), who had suffered frightfully from neuralgia for four years. At the same time I employed it in a case of severe hemioranial neuralgia with disorganization of the eye, in a young woman (E. P.) about eighteen years old. Both cases received decided benefit, neither were speedily cured; both had abscess in the neuralgic site, from the continuance of the localization.\*

I then varied the site of the injection, chiefly puncturing the arm, in both patients. The man went out cured, the young woman went to the Middlesex Hospital. She was the first patient treated by subcutaneous injection in that Institution. Under the care of Mr. De Morgan, the varied site of injection was had recourse to, and the same solution that I had used at St. George's was employed. She received great benefit, and has now been for several years free from neuralgia.

It appeared fair to deduce from these cases:—

Firstly. That in neuralgia equal benefit followed *distant* injection of the cellular tissue, as followed the injection of the *neuralgic site*.

Secondly. That localization was not necessary to benefit a given part.

Thirdly. That for certain reasons it was better not to localize.

The chief being:—1. The infliction of unnecessary pain; and 2. The almost certain risk of irritating, thickening, or inducing matter in the part from the repetition. 3. It moreover became evident, that a large class of neuralgia would be *excluded* from this treatment if it was necessary to inject the neuralgic site.

But as my experiments showed, such was not the case, I inferred, that diseases of any one part of the body could be effectually treated by injection of the cellular tissue of any other part. Before introducing this as a *law*, it would be better to furnish one or two *more striking* examples than the first two mentioned, and as regards cure, rather prolonged cases. I will take, for example, such forms of neuralgia as would have been treated in Edinburgh by the local injection.

\* These cases, with remarks upon them, are to be found in the *Medical Times and Gazette*, October 16th and 30th, 1858.



CASE I.—On the 3rd of June, 1863, Mrs. B., aged sixty-three, consulted me about an attack of sciatica from which she suffered. She had walked lame on account of the pain for two years. Rheumatism and great mental anxiety had preceded it. She had taken two or three grains of morphia daily, by the advice of a London physician, up to the time I first saw her. The atropine injection,  $\frac{1}{30}$  of a grain, in the arm, produced its characteristic phenomena upon the system; and forthwith removed the pain. She had no pain from that time for about a year, when she came up from the country and again received similar benefit.

CASE II.—In January, 1859, Mrs. R. had severe facial neuralgia, which had lasted some months, and defied ordinary internal as well as local treatment. I injected the arm of the same side of the body, with the acetate of morphia. It caused considerable gastric irritation, and yet cured the neuralgia. She has had no return of it since that single puncture six years ago.

CASE III.—G. C., aged nineteen, tic-doloureux, left facial region. Duration, three months, quinine and other treatment previously tried without effect for several weeks. Atropine puncture was used on November 16th, 1863, and at intervals of two or three days as the pain happened to recur; each puncture removed the pain before he reached home. He was cured in a fortnight. No return when seen five months after. The injections were made in the arm of the opposite side of the body.

CASE IV.—Mrs. A. T., October, 1863, came to the Dispensary suffering from facial and lingual tic of two years' standing; sleepless nights for months together. Atropine punctures in the arm were made on January 15th, 16th, and 18th, 1864. She has been free from pain up to the present date, general condition greatly improved since the pain has been removed. I will not take up time by giving more examples. These cases must suffice to show how injection of any part of the cellular tissue (provided the alkaloid employed be the correct one) will remove neuralgia, and a morbid state of the nerves in any other part of the body; and they clearly show how much larger a class of neuralgic affections may thus be treated, than was dreamed possible by the advocates of the exclusive method of Wood.

But, although Dr. Wood during many years employed the syringe for neuralgic pain alone, he was fully aware of the effect his local injection had upon the system generally. In the very first case that he treated, "the patient's eyes became injected, and looked just like the eyes of a drunken person." \*

It is curious, also, to observe that the two chief dangers that he alluded to, in his lecture in 1858, as likely to arise from in-

\* *Loc. cit.*, p. 722.



jecting an excess of the remedy, should have been phenomena *remote* from the locally—injected—neuralgic site; affecting, to wit, the stomach and the brain, irritating the former organ, and narcotizing the latter. “It is truly astonishing,” he said, “to see how rapidly it affects the system. If you throw in a large quantity, you will see the eyes immediately injected, and the patient narcotized, and a few minutes afterwards you will see him in a profound sleep.”\*

Notwithstanding all this, he considered that the injection *to be* beneficial, must be introduced *locally*.

“The local effect depends,” he said, “much upon the affinity between the particular medicine administered, and the tissue to which it is applied;” one might deduce, as he says, that every disease has a local and general effect, that he regards these other effects on the brain, the eye, and the stomach, simply as sympathies, rather than as *direct* effects from the anodyne injection.

Whatever may have been his view of these effects, he made no application of his knowledge of them to the *general treatment* of disease. I do not wish by these remarks, in any way to disparage the discovery of Dr. Wood. Far from this, I have always in my papers given him his just credit; but I have so often found my own investigations overlooked, and my own special results attributed to Dr. Wood, that I venture to take this opportunity to explain more fully than heretofore, his theory and my theory; his practice and my own, the point that he attained to, and the point from which I have started.

In dismissing this first part of my subject, I would draw the reader's attention for a minute to a most common error of nomenclature. Medical men often tell me, “I have tried your *endermic* plan, &c. ;” *endermic* is not the proper word; and as applied to cases of sciatica it is mostly wrong. In neuralgic cases, Dr. Wood no doubt did inject, and ought, upon *his* principle, to inject into the tissue of the skin, and not beneath it; at all events, in certain cases; but the method I am advocating is, in its aims and in its practice, *more than skin-deep*; the fluid is passed beneath the substance of the true skin, the organs curatively affected are, as now to be shown, deeply placed.

Of the many foreign surgeons, Becquerel, Hérard, Trousseau, Bretonneau, and others, who at once, on the publication of my series in the *Medical Times and Gazette*, 1859, tried the injection, M. Behier, of the Beaujon, is the only one who I can find opposed my theory of the non-necessity for localisation. “Elle doit l'être au niveau du point douloureux,”† he says, and gives two cases *only*, in which distant injection had not answered. But I submit that in the majority of the cases of sciatica, treated

\* Loc. cit., p. 722.

† *Bulletin Thérapeutique*, vol. lvii.



by the puncture by medical men who think they are using *Wood's plan*, that method is not really followed: those patients have neither been treated endermically, nor locally, for the injection has been *below* the true skin, but *above* the fascia over the sciatic nerve. The injection in the arm would, in those cases, have equally cured the sciatica.

I may here mention that Dr. Fuller, of St. George's Hospital, was the first author to acknowledge my theory of the non-necessity for localization,\* in his work on rheumatism.

I will now pass on to the second part of the subject—viz., the injection of medicines *into the cellular tissue*, in order to ascertain their *general effects* upon the system. This first took place in November, 1858.

CASE V.—Edmund Harrison, under Dr. Page, at St. George's Hospital, suffering from delirium tremens, was the first case thus treated. He had been very violent, and without sleep for two nights and three days. Half-grain doses of morphia, by the mouth, had been repeatedly given with no effect. I injected, at the request of Dr. Page, one half-grain into the neck; the patient was soon quiet, and slept altogether about twelve hours. He rapidly got well with the aid of two subsequent injections.†

From the good effects of the morphia in this case and a few others, I deduced—

“That by the introduction of narcotics into the cellular membrane of the body, we have a mode of attacking and subduing cerebral excitability, *more rapid, more certain, and more pure in its action* than by the stomachic doses.”‡

Such was my proposition in 1858 relative to cerebral diseases. It was silently received but practically taken up by many leading men, especially in the hospitals of large towns.

How totally different were the conclusions of Dr. Wood in 1855, has been lately pointed out by Dr. Blandford, in a letter to the *Medical Times and Gazette* of July 22, 1865. In that letter, Dr. Blandford most frankly and kindly gives me credit for “having discovered and taught that central diseases—as delirium tremens, acute mania, melancholia, chorea—are to be cut short and cured by this method.” The following is the passage from Dr. Wood's paper of 1855, which I have lately had an opportunity of perusing:—“I have tried this mode of using narcotics, on some other cases not so appropriate; I am quite satisfied that in these not unfrequent cases where the disease has a *centric*, not a *centri-petal* origin, *it is quite useless*, unless from the power which it may for the time exercise on the imagination.” §

\* Fuller “On Gout and Rheumatism,” 3rd edition, p. 461.

† See *Medical Times* March 20th, 1859. ‡ *Medical Times*, p. 310, 1859.

§ *Edinburgh Medical and Surgical Journal*, 1855, page 273.



This passage refers to *neuralgic* cases of *centric* origin; it shows that Dr. Wood had used the injection in such cases, and found "it quite useless." Dr. Wood was fully aware that "profound sleep" often resulted from his *local* injection of different parts of the body for neuralgia, *not* of cerebral origin; but he never held the view, or gave any public proof, if he did hold the view, that those centric affections, such as mania and delirium, for which I first proposed it, could be curatively treated by subcutaneous injection.\*

On the other hand, my own experience of the last few years only the more corroborates my opposite conclusion, and even leads me to add the following:—That in cerebral affections, medicines called anodynes frequently act so far more effectually, and so differently from the stomachic doses of the same, as almost to warrant us in considering them as different medicines.

Let morphia be taken as a type, it is the agent used more than any other, and has, therefore, been no doubt used both ways by many now present. Taken by the stomach in any ordinary case, let us see how it often acts.

It makes the patient feel sick and qualmish, it nauseates, it even produces vomiting, it causes sleep, but the sleep is disturbed and excited; the patient dreams more than usual, he awakes in the morning with a dry mouth, with a coated tongue, he feels sick on waking, and does not enjoy his breakfast, neither do the liver or the bowels act as usual, he feels a tightness, or a weight, or a giddiness in the head, throughout the day. In fact, the agent given by the mouth to *reach* and to *quiet the brain*, has acted as an irritant to the pneumogastric and sympathetic nervous system in contact with which it was first brought.

Let us now see how the patient fares with the same dose given by the cellular tissue. The morphia goes by a shorter road and reaches the goal at once. The pulse instantly rises, the system glows, the face may slightly flush as the skin gets warm, and rapidly perspires. The pulse then goes down ten to twenty pulsations below the normal. The brain is soothed, sleep is gentle and happy. The patient awakes restored. There is no dryness of the mouth, no nausea, no sickness nor constipation of the bowels, for the morphia has gone to the brain by the shorter and more direct road. The skin is more acted on by this mode, not as a result following the nausea of the *stomachic* dose, but almost as a *direct* effect synchronous with the *first* quiescence of the brain.†

\* See foot-note to page 17.

† A curious effect that I have frequently seen from morphia when thus injected, is a great desire of the patient to rub the side of the nose. I am not aware of this nasal symptom being common from stomachic doses. Another effect which I have not unfrequently observed, is a decided



Such is the general difference of action when anodynes are given by the mouth and the cellular tissue. That nausea, and giddiness, and sickness, never follow the injection of the cellular tissue, I cannot testify to. They will sometimes occur, but with careful discrimination as to the dose, and due allowance for peculiar constitutions, very rarely. I used to hear of this treatment being laid aside on account of the sickness: it occurred twice in the first seventeen cases that I treated. The last few years, I have hardly found it cause sickness in any case. This I partly attribute to the injection of smaller doses, and partly to my not localising the injection when treating neuralgic cases.

It will, I presume, be allowed me that there is less shock to the system caused by injecting a part *less* freely endowed with nerves and not morbidly sensitive, than a part in which pain, tenderness, and excessive nervous sensibility exist. The sickness, as I have elsewhere shown, that may, though rarely, attend this little operation, occurs either at once, through a kind of shock, or as an ultimate effect of super-narcotism, at the end of ten or twelve hours.\*

increase of appetite within an hour. This is a directly opposite effect to that which usually follows the stomachic administration of morphia.

\* *Medical Times and Gazette*, p. 252, 1859, and page 47 of this Pamphlet.



## CHAPTER II.

*Classifies and briefly describes those Cases of Emergency in which this method will often subdue the disease at once, even when the ordinary treatment had been previously used with little or no beneficial effect.*

HERE I would draw attention to the diagram placed at the end of this chapter. As there shown, injections may be employed either *locally* or *generally* with a therapeutic object in view. The local bracket shows what had been done in the matter of subcutaneous injection before 1858. The general bracket shows the amplifications of the injection, as practically worked out by myself and others, from that date to the present time.

Had the local theory advanced by Dr. Wood held true, the diseases in the general bracket could not have been cured by the cellular injection.\* It is there shown how large a class of cases can be treated by the hypodermic method. If the list is a large one, it only shows the greater value of the mode of treatment ; though small in number compared with those that afflict humanity, still the diseases therein mentioned, rank among the most serious that it falls to man to suffer.

There are mania and delirium among the first class, there is lockjaw in the second ; fever, cancer, and poison cases are down in the list. There may be those who would laugh at that diagram, who would treat those diseases by the mouth, and only so. In the *minor* forms of all those diseases, I should do so likewise, but in the majority of them there comes a time when the fight is between the disease and death. In the *cerebral* subdivision the indication is to turn the scale between the sleep and delirium, sanity and insanity, mania and death.

In the *spinal* cases, convulsion or spasm must be arrested

\* During the last few weeks, Dr. Wood has, in a controversy in the *Medical Times and Gazette*, put in a claim to the effect, that *ten* years ago he suggested the "general use of the syringe." Whilst admitting that he might so have done, his suggestion, or rather hypothesis, had publicly given birth to no practical results, when in 1858 I opposed the local theory of Wood, and proposed and practically showed the value of the treatment in *non-local* affections. That gentleman, should *then*, had he really discovered the *modus operandi* and the value of these injections for *general* treatment, have asserted his claim, and not now after the lapse of so many years.



whilst exhaustion and death are impending. It should not be forgotten that this treatment is especially for *serious cases*. It is in them that its value is really seen. It is abused when employed in minor or trivial maladies. Every remedy of any worth has been and may be abused; we can hardly expect this one to claim complete exception.

I will now proceed to indicate a few of the special advantages that attend the injection of medicines into the cellular tissue, when used for the treatment of diseases *distant* from the site of injection.

1. For derangements of the *cerebral nervous system*, we have, in the hypodermic method, a means of treatment, far superseding in its immediate efficacy any other mode of medication.

In *cerebral* cases, which I have placed at the *head* of the list, we have hardly to consider pain at all. We have to deal with a sensitive and perceptive organ, not with a nerve. An organ which, for the due performance of its functions, ought to be at rest nearly one-third of our lives, a third of each day. Pain in these cases is only an occasional symptom—it is one among others of cerebral nervous exhaustion.

The more frequent symptoms of cerebral over-taxation are insomnia, irritability, excitement, melancholy, delirium, mania, loss of reason, &c.

These I submit to be all phases or degrees of cerebral excitement and exhaustion—the one merging into the other; the mildest often becoming the most severe, simply because it was not checked in time. *Insomnia* is a cerebral condition that may come on during any bodily illness, whether accompanied by pain or not. The *anxiety* attending the illness may often be the only cause of the wakefulness in a nervous and irritable person. It may occur without any bodily disease, as in the hysterical, &c.

Prolonged wakefulness for many nights or weeks together may lead to excitement and delirium in one temperament, to melancholia in another, later perhaps in life. Opium and morphia will usually cure these derangements—it will *give* sleep and prevent simple insomnia going from bad to worse. In many cases the opium does its duty well, when given by the mouth: in others, it distresses the patient in various ways. Where the natural tendency is to relaxation of the bowels, it seems to suit better than at other times. When constipation is natural it makes matters, in that respect, worse.

Given by the cellular tissue neither morphia nor opium ever constipate. I have used the morphia injection for weeks together, in cases of chronic disease, the bowels acting daily—but never acting without medicine in the same patients, if the morphia was given by the mouth.



Neither is the stomach deranged, nor the appetite interfered with, as with the stomachic dose. In many cases I have found the appetite *improved* by the injected dose.

2. In *melancholia*; the effects of morphia thus administered, are decidedly beneficial. Opium in some form seems to replace the missing elements in the desponding and sleepless brain, and it does so without producing anorexia, &c. The morphia-puncture will in a few minutes restore the lost equilibrium—it will make the patient feel cheerful and happy; he will then eat and take exercise, or go through those professional duties he had entirely despaired of performing, perhaps only an hour before.

3. But it is in *delirium tremens* and in *mania*, more than in any other disease of this class, that the immediate benefit is most manifest. Although differing in their causes I class these diseases together, for whether *mania* arises from violent excitements, from drink, or from exhaustion, as in the puerpural woman, still it resembles *delirium* from drink in this important symptom—the *insomnia*.

Most cases of this description have had large and oft repeated doses before they are admitted into hospitals; but they have failed to give sleep—the insomnia is almost the essence of the disease—a good sleep obtained, the case is half cured.

It is in this class of cases that a single dose, administered beneath the skin, will at once break the neck of the disease. It will often at once stop the delirium, correct the mental aberration, and remove the exhaustion as produced by the injection. It is the food of the brain, the sustainer of nerve-force.

*Much* is gained by this plan in *delirium tremens*. The patient will not swallow. The subcutaneous injection obviates that difficulty—the stomach will not absorb or digest the opium. The morphia put beneath the skin is absorbed in five minutes. Time is lost by the stomachic dose; it is gained by the hypodermic; uncertainty attends the one plan, certainty the other. Dr. Robert Ferguson\* told me he counted twenty-four one-grain opium pills in the stomach of a patient who had died in some hospital—unabsorbed, those pills can have done no good; but rather harm, embarrassing the prescriber.

Another advantage is that *restraint is avoided*. During the hours and days that we might wait for the unabsorbed opium to act—the violence, or rather the incessant continuance of the muscular movements, has often seemed to indicate the necessity for the strait-waistcoat. This helps to cause, or increase venous

\* The death of this esteemed physician has occurred since this paper was written. Dr. Ferguson fully discussed the action of hypodermic injections with the author the last time they met. This opportunity is taken, to show the author's gratitude, for the many acts of kindness he had received from Dr. Ferguson, more especially in relation to this mode of treatment.



congestion. In fatal cases Dr. Barclay thinks the opium has often borne the blame when the forcible restraint was really more at fault.\*

By the hypodermic plan, the *necessity for restraint* is done away with; the patient, if not asleep in thirty minutes, is almost always perfectly quiet, neither talking nor moving: and thus we see another advantage that we gain, *the avoidance of exhaustion*.†

The cases of this class, that I published in 1859, excited some little interest.

Dr. Fuller, Dr. W. Ogle, Mr. Williams, of Liverpool, Dr. Childs, and others, tried the hypodermic method of treatment soon after the publication of my observations, and either published cases themselves, or gave me leave to publish those they sent me. The foreign journals translated the cases; Messrs. Behier, Courty, and others abroad discussed the theory; memoirs were read upon it at the Academy at Paris; Scanzoni at once employed it, at Würzburg, in cerebral convulsions, and published cases to corroborate the correctness of "the positions" I had laid down. St. Bartholomew's, the Middlesex, and other hospitals at once employed it in cerebral affections. One remarkable case of furious mania, at the latter institution, was positively injected with two grains of morphia—*far too large a dose* to employ as a rule—but in ten minutes the most perfect quiet, succeeded the furious excitement of mania; and the man recovered. In private practice it also became rapidly used in 1859. In the *System of Surgery*, edited by Mr. Holmes (who used it with success in *delirium tremens* in November 1859), I find that the author of the article on *delirium tremens* speaks thus favourably of the method.

"Very recently, attention has been called to the possibility of introducing narcotic substances into the cellular tissue, by what is called the "hypodermic method," in cases in which they have seemed to fail in producing their effect when taken into the stomach.

"Instances are recorded ‡ (here referring to my cases), in which this practice has been adopted in *delirium tremens*; and without claiming for it an invariable success, it is well to bear in mind that the assimilating powers of the stomach are always much interfered with; and that, consequently, while the remedy itself is very likely to escape absorption, its presence in the stomach is also apt to increase the anorexia and inability to assimilate proper nutriment, which stands so much in the way of successful treatment. It may also be made the means of

\* Article "On Delirium Tremens," in Holmes's *Surgery*, p. 333, vol. i.

† See Appendix of this Pamphlet for cases, page 60.

‡ *Medical Times and Gazette*, 1859, vol. xviii., p. 310, &c.



bringing the patient under the influence of a narcotic, when his resistance prevents its being administered in the usual way. In either case, the injection of a few drops of solution of morphia under the skin may be practised with perfect safety, if due caution be exercised, and is to be regarded as an important adjunct in the treatment of the disease."

I should have felt more gratified if Mr. Holmes's author, thinking thus well of the treatment, not apparently thinking it a "medical error," had done me the justice to mention my name whilst epitomising my facts from the *Medical Times*.

*Chorea*, being emotional in its origin, I have placed among the cerebral cases. Of this usually tedious disease I have treated two cases by the hypodermic method.

They were the most severe examples of the malady I have seen; in both of them the "insanity of the muscles" had so mastered the patients as to have abolished sleep: in both the skin was rubbed off the elbows and heels by the incessant muscular action; the act of swallowing was with great difficulty performed by the patients.

The effect of the morphia puncture in both cases was almost magical—sleep, and subsidence of the muscular movements was the immediate result; both rapidly improved, but the one in the hospital died from sore throat, and abscess connected with it, whilst the other completely recovered.

Of *Puerperal convulsions*, as well as of *mania* from the same cause, I have had to treat several cases. "In such," Scanzoni says, "it will readily be allowed, opium and its preparations deserve the first place."\* As in the previous diseases, opium can often be administered by the hypodermic method with success in this, when none has attended the ordinary modes of its administration.

To resume, briefly, concerning cerebral affections. This treatment has advantages especially its own, restoring the proper function of the brain, composing, and giving it sleep and tone, whilst the *same medicine* otherwise given has only caused irritation, and delayed that cure, which, by the injection, would have been more quick, permanent, and effective.—(See page 56.)

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Passing to the spinal affections, we find the same advantages to attend the use of the treatment, whilst the medicine employed, and the nature of the disease, may vary much. Here *pain* in some form or other, *excessive muscular action*, or its *complete deficiency*, are the three chief evils to be contended with.

Insomnia in these cases is an induced or secondary evil.

Morphia is far from being the panacea, even when thus in-

\* *Bulletin de Thérapeutiques*, March, 1860.



jected, in this class of cases, although so valuable in cerebral affections.

Acute sciatica, for example, may prevent sleep for many nights together; the morphia injection may meet the insomnia, but it does not always cure the sciatica; it palliates the *induced* symptoms, but is not always the agent to strike at the root of *this* disease.

M. Ozanan, may rightly, I think, hold the view that the various alkaloids in opium have each a part of the nervous system on which they more particularly act—morphia, on the cerebral hemispheres; thebaine, on the upper dorsal; narceine, on the lumbar region, &c.\*

And so with other alkaloids: atropia and strychnine, I believe, strike more surely at the root of the sciatica in many cases, than does morphia or any opium alkaloid. They produce a more tonic change in the affected nerve; and they *do so best* when injected beneath the skin.

I have often wondered whether belladonna and its alkaloids fairly reach the affected nerve when given by the mouth. So long may they be given stomachically with little or no benefit. Do they undergo chemical transformation? is a question one may fairly ask. The woorali is nearly inert when taken by the mouth; I have given from three to six grains to a patient in the course of a week without any marked effect, by that plan; but I have paralysed the legs of a rabbit for many days with only the ninth part of a grain when injected.†

In *painful spasmodic affections* how important it is to be able at once to arrest both the *spasm*, and the *pain*.

In severe *colic* in a painter, who for hours had been doubled up in agony, a single morphia puncture relieved the spasm, and, of course, the pain, and the bowels, which had for some time been confined, acted of their own accord; the castor-oil that I ordered having been forgotten by the patient.

Dr. Ward, of Winkfield, has found the morphia puncture successful in this disease.‡

In *retention of urine*, when due to *spasm*, this treatment may be often useful, and relieve the patient in a very few minutes. I was led to use it in one case, having no catheter at hand; micturition took place in the course of ten minutes. When no hot bath is at hand, the catheter absent or contra-indicated, I venture to suggest the morphia puncture as a ready method of relief.

On the 5th of November, 1858, I believe the first case of

\* *Archives Générales*, p. 499, 1864.

† "Report on Colonial Medicinal Contributions to the International Exhibition, 1862."

‡ *British Medical Journal*, May 26, 1860.



tetanus was treated hypodermically; the patient had been admitted into St. George's Hospital with a gunshot wound. The injection in this case was morphia, which gave the patient sleep, but the spasms continued unaffected. I have treated a second case of traumatic tetanus, with morphia and woorali by injection, with benefit—giving sleep and diminishing the spasms, but the patient died from exhaustion, partly due to the length of time *the friends* allowed to elapse between the periods of feeding him. Since that time, many cases of lockjaw have been treated hypodermically, and a few cured. The agents that have been injected in this disease, have chiefly been the woorali, atropia, nicotine, morphia, and aconitina; the operators, MM. Vella,\* Briquet,† Courty,‡ Claude Bernard,§ Follin,|| Spencer Wells,¶ Dr. Benoit de Giromagny,\*\* Fournier de Souisson,†† &c., &c.

In *epilepsy*, the effects of atropia injected seem superior to the stomachic effects, being more permanent in curing the fits, and in lengthening the duration of time between the fits in chronic cases. There seems, indeed, to be a kind of tolerance of atropine in epilepsy, as there is in chorea in children, and occasionally in tic doloireux of centric origin; one-eighth or one-tenth of a grain will perhaps produce symptoms far milder than 1-30 or 1-40 of a grain will in other and milder affections. In paralysis, strychnia seems in some cases more beneficial than when given by the mouth.

Limited space prevents me from entering further upon this class of cases, interesting as the results are, of atropia in epileptic seizures, and of strychnia in painful and paralytic cases; these may form a subject for future consideration.

I pass now to another important object with which the hypodermic treatment may be used—namely, *to diminish vascular action and inflammation*.

When morphia and atropia are given by the mouth very little effect is perceptible upon the pulse. If they make the patient sick, the effect of depression, &c., is secondary; but injected beneath the skin, a primary, direct, and very different effect is produced upon the heart and arteries by these two agents: the one as quickly lowers as the other excites the pulse. Dr. Harrington Tuke felt the pulse of a patient with

\* *Medical Times and Gazette*, April 16th, 1859.

† *Medical Times*, October 1, 1859.

‡ *Medical Times*, October 22, 1859.

§ *Bulletin de Therapeutiques*, Nov. 30, 1859.

|| *Archives Générales*, Oct., 1864.

¶ *Medical Times*, Dec. 3, 1859.

\*\* *Medical Times*, Dec. 3, 1859.

†† *Archives Générales*, vol. 59, p. 577.



puerperal mania that I injected in Queen Charlotte's Hospital go down from 140 to 80 in four minutes. Mr. Holmes at my request the other day felt the pulse of a patient twenty minutes after an atropine puncture; the pulse had risen, as it usually does to 120. The deduction is, I think, plain that morphia thus administered may be used as a decided antiphlogistic, but atropine not so. T. B., in St. George's Hospital in April, 1859, suffered excessive pain in the head, with chemosis and severe inflammation of both eyes. Leeches, blisters, calomel, and opium, and morphia by the mouth, every three hours, failed to diminish the pain or arrest the inflammation. The morphia puncture acted like a charm; it completely removed the pain, and the inflammation then rapidly subsided.\* Dr. Ogier Ward in 1860,† just one year after the above case was described by me‡ as an instance of inflammation, wrote as follows:—

“Another conclusion may, I think, be drawn from these cases—viz., that pain of any kind, neuralgic or inflammatory, may be relieved by subcutaneous injection; and as we can only explain the more rapid action of opiates administered in this manner by their immediate absorption into the circulation, it follows as a necessary corollary that in violent pain from acute inflammation, we need not wait to subdue it by antiphlogistic remedies, but proceed at once to the use of anodynes.”

Thus, independently, and from his own experience, Dr. Ward has confirmed my prior views on the subject.

In *peritonitis* I have found the morphia puncture of great value. It helps at once to check the three prominent symptoms—the excessive pain and tenderness, the rapid pulse, and the short quick breathing; it then gives or *allows* sleep.

In *ileus*, in a severe case in which there was every symptom of perforation of the bowels, Dr. Godwin tells me he found half a grain of morphia injected beneath the skin to relieve all the urgent symptoms in about ten minutes.

In ophthalmic practice, Dr. A. Von Graefe has found the hypodermic injection of especial value; and has written a paper to show the various objects with which it may be used in ophthalmic surgery.§

In *ague* and *fever*, the hypodermic injection has been extensively used, especially in the Smyrna Hospital, by Drs. Chasseau and McCraith; also by Dr. Moore, of Bombay; also more recently by Dr. Desvigne in France. All these physicians agree in the superior efficacy of quinine when injected into the cellular tissue over the stomachic doses. The same rule holds good with quinine as I had shown was the case with morphia—viz., that a lesser quantity was equal to a greater, given by

\* *Medical Times and Gazette*, Sept. 10, 1859.

† *British Medical Journal*, Sept. 15, 1860.

‡ *Loc. cit.*, *Med. Times and Gazette*, see page 50.

§ *British and Foreign Med. Chir. Rev.*, p. 267, 1864.



the mouth. "Four or five grains," says Dr. Moore, "are equal to five or six times that amount by the mouth."

I must protest once more against the way all these gentlemen introduce the quinine—namely, with a common syringe after incising the skin with the *lancet*! According to Dr. Desvigne, abscess and sloughing of the cellular tissue are results not extremely uncommon, but such as, I think, should never occur.

For the various forms of *uterine pain*,\* especially for dysmenorrhœa, the hypodermic treatment has been used by Dr. H. Bennett, of Mentone. In all cases, he says, he obtained the benefit in from fifteen to thirty minutes without any of the drawbacks which follow the stomachic administration.

I cannot finish without remarking, though very briefly, on the use of this treatment for *incurable* disease. In my own hands it has been a boon to many patients for months, perhaps, together, some with incurable neuralgia, others with *cancer*, or the agony of diseased joints. Life is made bearable by this plan to these poor sufferers. The economy of the amount of the anodyne required holds good in the majority of these cases. Dr. Giles tells me that he has now a case of cancer under his care in which one-third of a grain injected on alternate days gives all the relief that two grains daily had previously given by the mouth. Such has often been my own experience in this disease. In the cancer wards at the Middlesex, Mr. Watts and others tell me that the morphia puncture has for a long time been the main treatment employed, some patients being injected once, others twice, daily. Mr. Charles Moore, Surgeon to the Middlesex Hospital, said (at the conclusion of my paper read at the Royal Medical and Chirurgical Society), "that no plan had been more deservedly put forward than this, and nowhere had its use been better shown than in the cancer wards of the Middlesex Hospital. The experience (of Mr. Moore) enabled him to confirm what the author (Mr. Hunter) had stated, as to the advantage of this plan of giving morphia." He (Mr. Moore) had also convinced himself that the action of the morphia he thus injected *was not local only, nor even chiefly local, BUT GENERAL.*† As an *antidote*, and as a diagnostic test, I have long since

\* Dr. Tilt, *Lancet*, 1861. Dr. H. Bennett, *Lancet*, 1864.

† Mr. Freeman, writing upon "the hypodermic injection of morphia," says, "that the endowed cancer ward of the Middlesex Hospital has perhaps afforded as large a field for the observation of its effects as most metropolitan institutions of its kind, and in, perhaps, but few hospitals has the hypodermic method of morphia received so fair and impartial a trial in all varieties of cases, both medical and surgical. Long since it (the hypodermic treatment) has stood alone as the great remedy for pain in those malignant forms of disease, no other class of remedies seeming so efficacious."—*British Medical Journal*, June 24, 1865.



ventured to propose this plan as the most reliable in cases in which the agent to be employed is fairly soluble.

In conclusion, I have to apologise for the length of this communication. The novelty of the treatment and the importance of the subject to all branches of the profession will, however, be a full excuse on this score. The method in its performance requires on the part of the operator judgment and discrimination as to fitness of case and choice of drug, and especially care as to the mode of operating. On this latter point I must make two remarks: if the operation is carelessly done the fluid may come out; the operation must then be repeated, which is an awkward and unpleasant thing to occur in private practice; 2ndly, that the employment of concentrated solutions requires great care. A single drop may double the dose, and produce even serious symptoms.

In thanking most sincerely those medical men (more especially Drs. Ferguson, Page, Pitman, Mr. Cæsar Hawkins, Mr. Tatum, and others), who, being interested in this inquiry, have helped me from the first, let me conclude with this sentence, which, coming from no less a physiologist than Claude Bernard, has cheered me in thinking of the many hours I have given to this subject:

"I verily believe that the subcutaneous absorption which has, up to the present time, been employed only on man as the exception, ought to become the general method for the administration of all energetic medicines in their pure state."\*

\* "Recherches Experimentales sur l'Opium et ses Alcaloides," par M. le Dr. Claude Bernard, *Archives Générales de Médecine*, Oct., 1864, p. 455. At page 456 of the same article, this physiologist observes:—"I have given these soporific substances by the stomach, or by the rectum; sometimes I have injected them into the veins, the pleura, or the subcutaneous cellular tissue. I have examined, moreover, the differences that may result from these different modes of administration; but for the general results I am going to mention, I shall especially allude to the injection of the cellular tissue; this mode of acting gives the most regular absorption of their active substances, and furnishes the surest and most comparable results."



The INJECTION of MEDICINES into the CELLULAR TISSUE beneath the skin may be made	LOCALLY with	and GENERALLY by the HYPODERMIC METHOD of the Author. 1858.	1. CAUSTICS, for injecting Nævi, Aneurisms, &c. 2. ANODYNES, as by the Narcotic Injection of Wood Ditto of Rynd ...	1843 1844	Neuralgia (centripetal). Sciatica. Local Pain.
In CEREBRAL,	{	{	<i>Sedative.</i>	{	Insomnia.
			<i>Hypnotic.</i>		Mania.
			<i>Nerve tonic.</i>		Mania. " Puerperal. " a potu. Delirium. " tremens. " ebriosorum. Chorea. Hysteria. Neuralgia. Tic Doloireux.
SPINAL,	{	{	<i>Anodyne.</i>	{	Neuralgia. Tic Doloireux.
			<i>Anti-spasmodic.</i>		Severe pain, deep or superficial, as in Tetanus. [Rheumatism, Lumbago, Retentio urinæ, &c. [Sciatica, &c.
			<i>Hypnotic.</i>		Colic, &c.
and SYMPATHETIC NERVE Cases, Affections of the VASCULAR SYSTEM, and in BLOOD-DISEASE; as an ANTIDOTE and ANÆSTHETIC	{	{	<i>Tonic.</i>	{	Eclampsia (puerperal). Epilepsy. Paralysis, certain forms of.
			<i>To diminish vascular action and inflammation.</i>		Peritonitis. Pericarditis. Enteritis, &c.
			<i>To give tone and arrest morbid action.</i>		In Ophthalmic Surgery { various uses.— Fever. { Ague, &c. { Herr. V. Grafe. { Continued Fever. { McCraith Dysmenorrhœa. { Desvigne, &c.
as an ANTIDOTE and ANÆSTHETIC	{	{	<i>To palliate Incurable Disease.</i>	{	Dysmenorrhœa. Phagedæna. Vomiting. Cholera. Diarrhœa. Sea-sickness. Cancer, &c. (especially in Middlesex Hosp.) Hydrophobia { Intus-susception, &c.
			<i>For Opium, Strychnia, and other Poisons. Also as a Diagnostic Test, and a Therapeutic Test.</i>		
			<i>Before, during, and after Operations.</i>		



### CHAPTER III.

*First employment of atropine hypodermically in 1859—Quinine more effectual by injection—Cautions as to strength of solutions, and avoidance of local irritation—Physiological effect of atropine.\**

THERE is less a want at the present time of new therapeutical agents, than of a greater insight into the virtues of those we already possess.

The alkaloid, atropine, may be cited as an instance of a medicine, the whole value of which is at present but very little known. It was, indeed, looked upon as a deadly poison. In 1854, Neligan said: "The alkaloid atropine has not been given internally in medicine, in consequence of its highly poisonous action even in very minute doses;" and he mentioned a case in which "dangerous symptoms of poisoning arose from three or four minims dropped into the eye of a solution of one part of atropine to 600 of water.†

In 1855, Dr. Brooks was described by Pereira as having given atropine internally for a painful affection of the face; the dose, varying from one-thirtieth to one-sixth of a grain, requiring great caution. The *sulphate* of atropine is intended for external use only.‡

Hardly recognised as an internal remedy, and described as a poison of such great power, it was with no small anxiety that, in 1859, I first injected atropine beneath the human skin. And there is need of anxiety and of extreme care in the first trials of hypodermical agents of great power. It should be impressed on our minds that, whilst too large a stomachic dose may work its own remedy by the vomiting induced, every atom introduced beneath the skin circulates in the blood and produces its full effect.

In 1858 and 1859, papers were communicated by me to the *Medical Times and Gazette*, establishing the application of "the puncture" to the treatment of diseases affecting *the organism generally*, or at points far remote from the point of medicinal

\* This paper appeared in the *Lancet*, October 17, 1863.

† Neligan's "Materia Medica," p. 275.

‡ Pereira's "Materia Medica," vol ii., p. 559.



introduction. The truth of this, and the special value of the method in subduing cerebral and spinal excitement, were rendered manifest by the series of cases I submitted to the profession; and the credit of opening this new path to the treatment of disease, and of non-local affections, was accorded to me by Scanzoni, Ogle, and a few others of the many who speedily furnished the journals with their experience of the "hypodermic treatment."

The alkaloids of belladonna, aconite, and other medicines, were first employed hypodermically by myself at the time when the above-mentioned papers were being published, and in which mention of them is made, although the bulk of the observations and cases were relative to the action of morphia. In a few months from that time, the French journals teemed with observations on the atropine injection, M. Courty being the first, I believe, to write on the subject abroad, and Dr. Cowdell, of Dorset, the first in England.

Though the value of this sub-surface mode of treatment is most marked in affections of the nervous system, from the rapid way in which it will produce sleep and lull or cure pain, still there are many other affections—blood diseases—which show the superiority this method has over others in checking disease. One important application of this method has lately been recalled to notice in the *Lancet*, by Dr. Moore, of the Bombay Medical Service—namely, the treatment of malarious fevers by the hypodermic injection of quinine.\* "I believe," says Dr. Moore, "that four or five grains of quinine injected beneath the integument are equal to five or six times that amount taken into the stomach." This is of no small importance, even in an economical point of view, where numbers, as in the army, may simultaneously be seized with the fever; and if quinine is the "specific," there is every reason to believe one or two doses thus given are sufficient to check the disease; just as morphia, so given, will arrest delirium tremens when larger stomachic doses had failed.†

Concerning the quinine solution for injection, the chief difficulty is to make it of that concentration that the dose shall be contained in a very few drops. Dr. Moore says, "I use the strongest solution of quinine which can be prepared"—namely, thirty grains of quinine to half an ounce of water. Now the solution that I have employed for neuragia is just double the strength of Dr. Moore's, and if it could be made more concentrated the better. The less the bulk of fluid injected the better,

\* Dr. Chasseaud, and Dr. J. M'Craith, of Smyrna, had previously used quinine in fevers with benefit. The plan of Dr. M'Craith, of lancing the skin to insert the nozzle "with the syringe itself," is quite unnecessary, and in many ways objectionable.

† *Medical Times*, 1859, p. 254.



for many reasons. Thus, two or three minims in bulk cause no pain whilst being injected; whereas twenty or thirty minims distend the tissue, cause pain in proportion to the amount, and, if the tissue at the point injected be not sufficiently loose, the fluid may escape beside, or on the withdrawal of the gold-pointed nozzle. I have never injected, in point of bulk, a larger quantity than thirty minims, and I have found inconvenience from much less than that quantity.

*But is there no fear of abscess or diffuse inflammation following the puncture?* So frequently have I been asked this question, that I take the present opportunity to reply. No; certainly not. For the last three years I have seen no local ill effect of any kind from the puncture. I do not attribute this to the observance of one, but of many little points. As regards *single* punctures, much, I believe, depends upon the care and the celerity with which the puncture is made. To bungle with the point of the instrument is to irritate, and an irritated puncture might inflame by friction. To employ a fluid otherwise than neutral would also irritate. True, some fluids cannot be made perfectly neutral, but so nearly so that no irritation occurs. In cases where many injections are required, abscess or inflammation of the cellular tissue may result, if the puncture be repeated in the same spot.\* As, however, no object is to be gained by the localization of the injection to any one point, the fear of producing irritation should lead us to vary the site of the puncture. The causes of the evil have but to be known to be avoided.

But to return from this digression on minor essentials to the action and hypodermic use of atropine, the object of this communication.

Much less marked are the effects of atropine on animals than on man: that is to say, a larger proportional dose is required to produce the same effect. The symptoms with the sub-surface doses, are much the same in man and animals.

\* It is as well here to mention that, in October, 1858, the author of this paper first opposed the theory that localization of the injection to the neuralgic site was necessary; and, as the result of his experimental investigation of the matter, whilst house-surgeon at St. George's Hospital, drew these conclusions:—

“1. That, by the injection of the narcotic into the cellular tissue of a part distant from that affected with the neuralgia, the relief that follows appears quite as great as when the injection is into the cellular tissue of the neuralgic part.

“2. That therefore the idea that the relief results from the localization of the remedy in the painful part is erroneous—equal relief being afforded in either case (injected into the painful part or elsewhere).

“3. That, with the abolition of localization of the remedy, the great objection to narcotic injection is done away with; because no inflammation (irritation) or abscess follows a single narcotic injection.”—*Medical Times and Gazette*, October 30, 1858.



One-sixth of a grain produced upon a rabbit (4lb. 7 ozs.), when injected, but very little effect; it caused dryness of the throat, however, in three minutes.

One-third of a grain, on a rabbit of the same size, dilated the pupils, acted frequently upon the bowels and upon the bladder, and quieted the heart's action; but produced no loss of consciousness, no sleep, muscular tremors, or loss of co-ordination.

The same dose injected beneath the skin of a rabbit, previously narcotised with morphia, acted as an excitant to the brain, the heart, and the lungs, arousing the animal in two minutes from the comatose state produced by the morphia, so that it walked about with an intelligent air; it gave strength to the pulse, and increased the rate of respiration, which is always much lowered by a full dose of morphia.

The effect of atropine on narcotised rabbits is generally of but short duration: consequently, to nullify the effects of opium narcotism, small and frequently repeated doses of atropine are of more benefit than one or two full doses.—(*Experiments*, 1860.)

By the hypodermical administration of the agents, morphia and atropine, we see how very differently they produce their influence, both as regards their mode of action and the parts of the nervous system they may be said "to attack."

As morphia is our anchor or trust in many cerebral affections, as surely as without sleep we die, so I purpose, if possible, to show how "specific" is the effect of atropine on diseases peculiar to certain nerves.



## CHAPTER IV.

*Comparison of the first effects of morphia and atropine upon the system—Instances showing how the former predisposes to sleep and to check inflammation—Atropine not a narcotic, but a nerve-stimulant and nerve-tonic in small doses.\**

*Modus operandi of the treatment.*—Even now the mode of action of our narcotics and sedatives is so little known, or so little thought about, that practitioners are in constant doubt as to which agent they should employ in such and such a case. The special parts of the nervous system upon which the various alkaloids act are not sufficiently considered. Most of these medicines have a first effect upon the system, that of stimulation, and a second effect of a sedative, tonic, or other nature, now to be considered.

By the hypodermical administration of the medicine, these different effects are better seen than when it is given by the stomach. The action of the medicine is better analyzed.

The secondary effect, be it sedative or tonic to the nerve, is more effectually brought into play upon that nerve hypodermically than when given by the mouth; for by the latter plan the first effects lose much of their value, and merge so gradually into the second, that the impression upon the nerve is frequently too feeble to set up the desired healthy action in that nerve—in other words, the medicine fails to be beneficial. This will more plainly appear in the sequel.

When a dose is given by the mouth, the *first systemic effects* are slowly, more gradually, developed than when injected beneath the skin. This is because it has to pass through the portal circulation ere it reaches the heart; it is also less effective because it reaches the heart *with less force*, being taken by driblets, as it were, to that organ and the lungs—the head quarters of the systemic circulation. But introduced into the cellular tissue, the absorbent vessels of which at once convey it to the fountain head of arterial supply, the first effects upon the systemic circulation are really more powerful, and can be better observed. Much of the subsequent good, moreover, depends upon this first impression.

\* This paper appeared in the *Lancet*, Dec. 12, 1863, p. 675.



*Comparative Observations.*—Let the first effects of the alkaloïds, morphia and atropine, be observed on the same patient.

*Effects of morphia on the circulation.*—John A——, in 1860, with sciatica of some years' standing, was injected in the arm with half a grain of morphia. The pulse at the time was 80, quiet and small; in one minute it was 76, and fuller and stronger in quality; and in twelve minutes, although the quality remained full, the rate had diminished to 66. The skin circulation was by this time so influenced, that the patient felt hot and the skin moist. The brain circulation was influenced; the patient was already drowsy. He slept better that night than he had done for months. Though the patient was not excited at the time of the injection, still the pulse was lowered.

If a patient is excited and the pulse high, the action of the heart is diminished in proportion to the dose injected. Thus, in mania, I have reduced it from 120 to 80 in four minutes. The *respiration* is likewise quickly diminished in frequency by morphia. Take delirium tremens as an instance. In a very few minutes the patient will be seen to breathe slowly and to draw sighs, even while still sitting up and refusing to lie down. In a few minutes more, as the circulation in other parts comes under the anodyne influence, he will lie down and sleep.

Thus the first effects of injected morphia are upon the heart and its arteries, and upon the lungs; and thus sleep is brought about by the diminished action of the heart, by the diminished rate of respiration, and consequently slower circulation in the brain, and diminished oxygenation of the blood. At the same time cutaneous action is increased, and this is in a measure due to the diminished action of the lungs. This first and lowering effect produced upon the circulation is a point of practical importance in the treatment of inflammation.

*Calomel*, so prejudicial to some constitutions, may be to some extent dispensed with, where the inflammation is treated with the injection *early*, when great pain accompanies it, and tissue has at present become little involved in the products of inflammation.

The acute pain that accompanies the early stage of inflammation of the eye, the pleura, and the peritoneum, are cases where a single injection only will do more good than doses of calomel and opium repeated at intervals by the mouth. How is this brought about? Much depends on this *first* and *decided check* that the injected dose gives to the heart and lungs, and to the virtue of the agent in relieving pain.\*

\* To be able to produce this first and decided check to the activity of the circulation, is very important in many cases, and can only be obtained to perfection when the agent is so given as to pass *directly* into the systemic circulation. The hypodermic I believe more efficient than the endermic



*The first effects of atropine.*—These are likewise manifested upon the circulatory organs, the heart and lungs; but they are very different from those of morphia, and the after effects are equally so.

The patient, John A——, before alluded to, had a fresh attack of sciatica in March, 1860, brought on by exposure. On the 18th I injected one-eighth of a grain of atropine, his pulse at the time being 88, the patient having just been walking. This experimental dose was three or four times larger than that which will usually be found beneficial. In three minutes it was 96; in five minutes, 96; in six minutes, 108; and in ten minutes, 96. Twelve hours after the pulse was only 56. This patient felt a glow all over him three minutes after the injection, and the pupils were dilated in four minutes. The next night I repeated the same dose, the patient being at the time in bed, with the skin warm and the pulse at 60, small and quiet as usual. In eight minutes it had risen to 96, and was stronger and fuller; and at sixteen minutes, when I left, it was still 96.

Aug. 17th, 1859.—Mrs. H——, with facial neuralgia, was injected with the twenty-second part of a grain, the pulse at the time being 80; in five minutes it was 120, and continued about that number for the next ten or fifteen minutes.

Jan. 13th, 1862.—J. W—— had sciatica. I injected the twenty-second part of a grain, the pulse being at 60; in two minutes the volume of the pulse was increased, and in frequency it rose to 72. In seven minutes the leg felt warmer; the pain left it, and the pulse began to go down again.

These instances are sufficient to show that the heart is almost instantly stimulated by the injected atropine; it beats more powerfully and quickly, and the pulse becomes fuller and stronger for a time. If the dose is too large, the character of the pulse is soon altered, and it may become small, irregular, and even slower than normal.

The respiration is not affected as it is by morphia, but becomes in some cases short and hurried, and in animals is seen, also, to become irregular from full doses.

If sleep is produced by atropine, the respiration does not become so deep or stertorous as from morphia. One patient, Capt. S——, in 1859, slept well from the twenty-fifth of a grain; the breathing was deep, good, and quiet; the pulse continued at 100 throughout sleep.

*Other effects of atropine.*—Almost as soon as the effect of the injected dose is seen upon the heart, atropine affects the throat.

method for this end, and much more efficient than when the portal circulation has first to discuss, absorb, or digest, the medicine presented to it.



If the dose is an ample one, the dryness of the throat and attempts to clear the windpipe occur in from four to five minutes. If only the eightieth of a grain, it may be half an hour before the throat is influenced. In doses larger than the thirtieth of a grain, sickness, or rather retching, which frequently occurs without sickness, will in some people take place; and, as with morphia, it appears to be an excess of first impression, or an ultimatum of general effects—I mean either to occur at once, or at the end of several hours.

*Upon the bowels* the injected atropine does not seem to act so frequently as I am told it does when given by the mouth. Still I have found it do so from as small a dose as the eightieth of a grain. In the same way, injected morphia does not produce its opposite effect—that of confining the bowels—so much, if at all, nor does it derange the stomach, nor coat the tongue, as when given by the mouth. The effect upon the skin and the kidneys I do not propose now to mention, but to confine these remarks to the more specific effects of atropine upon certain nerves.

*Effect upon the brain.*—Let me first dispel the idea that atropine is a cerebral narcotic. I do not consider it as such. Atropine is rather a stimulant at the onset than a sedative. Its first effects upon the heart, lungs, and general circulation are not those that at all predispose to sleep, as I have shown those of morphia do. But it is occasionally a narcotic, and the sleep is, I believe, brought about indirectly. The *sensations* seem first to be benumbed, pain to be relieved, and sleep follows. The sleep of atropine begins with the eyes open, but the vision asleep, with a few vague movements of the hands; the respiration deep and regular, but not stertorous; and the pulse will continue twenty beats or so in the minute higher than usual.

*Summary as to the first effects of these two narcotics.*—It has been often questioned whether, by the hypodermical treatment, the influence on an affected nerve is brought about purely through nervous communication or otherwise. In 1858 I attributed the result to absorption, and I think these observations prove it to be so; not through the nerves, but through the circulation. I have seen a patient thrown into a glow, and the face burn, a few minutes after the injection. I have shown how the pulse is acted upon in less than three minutes both by morphia and by atropine—rendered slower by the first and quicker by the last, and, in the case of the latter agent, before the throat is made dry. If it was through nervous communication, the throat would be affected before the pulse. I conclude, therefore—firstly, that the early effects of a medicine, when thus administered, are upon the systemic circulation; taken into it by direct absorption, and by it conveyed to those parts, amongst



others, on which its *special* effects are subsequently manifested ;\* and secondly, because the circulation is so influenced, the special action of the medicine thus introduced is not only facilitated, but more quickly and effectually brought into play than by other methods.

*Of the special effects of atropine.*—These are manifested upon certain nerves, the chief of these being the sciatic and the pneumogastric. There seems almost an elective affinity between atropine and these nerves. The rapidity with which the throat becomes affected is well known; and by Dr. Thompson, of Philadelphia, belladonna is considered as almost a specific in incipient sore-throat. The following case will show the action of the medicine upon the sciatic nerve :—

CASE I.—A lady, aged sixty, consulted me on the 3rd of June last for sciatica, which had affected her constantly for about two years. Rheumatism and great mental anxiety had for a long time preceded the sciatica, which caused her to walk lame. For two years she had taken large quantities of morphia, without which she could not sleep, though she became restless and heavy.

I injected into the arm the thirtieth of a grain of atropine at four P.M. The next day the patient described her symptoms. A red flush had come out all over her body, and she felt very hot, soon after the puncture. She dined at eight o'clock, retired at eleven to bed, and dreamed extraordinary things, and to-day finds the pain gone, and the leg stronger to walk on. The pulse was 80, and tongue clean. I saw the patient five weeks afterwards. She had "not had a particle of pain since;" had walked for some hours a few days before, and found the leg stronger every week. It is interesting to remark, that the morphia, which she could not be persuaded to leave off, has not nullified the benefit derived from the single dose of injected atropine.

\* Botkin's recent experiments on frogs show that no toxical effect from injected atropine is recognizable in a limb to which the access of blood is prevented by deligation of the artery.—Virchow, vol. xxiv.



## CHAPTER V.

### *On the Use of Atropine in Sciatica—Ischio-dynia—Severe Rheumatic Pains in the Lower Limbs—Conclusions—Also in Facial Neuralgia and Tic Dolozeux.*

IN the preceding case, it was seen how a single atropine injection beneath the skin acted as a direct tonic to the weak and painful sciatic nerve; and it was a fact to be noticed, that the patient had for about two years taken morphia, the so-called antagonistic narcotic, by the mouth, without relief, and that she continued it after the atropine injection without nullifying the benefit derived from the latter.

In the following case, morphia and atropine were both employed hypodermically by myself, about four years ago.

CASE II.—John A——, aged forty, spare and haggard in appearance, had for many years been afflicted with sciatica, and had attended on account of it at various hospitals and other charities, whence he obtained occasional relief, but never permanent benefit. A hatter by occupation, and living a long way from his work, I attributed the sciatica partly to exhaustion and insufficient living, partly to his standing much in hot and cold rooms alternately, which evidently kept up the disease.

In the early part of 1860, I employed the morphia injection with decided benefit; it removed the pain and gave him sleep, and so, from the good nights he obtained, he visibly became nourished. The morphia thus administered was so beneficial, that two or three injections would keep the man free from pain for two or three weeks together, until wet weather, fatigue, or some other cause, would again re-excite it. When he *did* suffer, he suffered acutely, with a dull heavy pain and numbness round the loins, the hip, and the thigh, in consequence of which, he had limped for four or five years.

Though so palliative, still the morphia was not curative, in that, exposure would re-excite the pain; I therefore injected atropine instead of morphia on the 18th of March of that year. This agent had the instant stimulating effect upon the circulation that I have already described: a glow suffused the whole body, and, curious to relate, the pain, already much mitigated by morphia, was brought back in all its intensity in about thirty



minutes. The dull heavy pain in the thigh, and the coldness, as of a flagstone, in the hip; the pupils were dilated; there was, giddiness, but no sickness. The dose was larger than I should now administer in such cases. I repeated the atropine injection the next night with much the same result; slight delirium followed, and no immediate relief to the pain, which rapidly subsided with a few morphia injections.

January, 1864.—Up to the present date, there has been no return of the sciatica; the man actively follows his employment, looks more healthy, has more flesh, and no longer limps in his walk. Whether the atropine assisted or not, and what its therapeutical action was, will be best considered after observing a few more cases.

CASE III. occurred two years ago.—J. W——, aged thirty-six, a driver to a florist, a man of thin, nervous temperament, had, in 1862, suffered from sciatica for four or five years in the left leg. The pain occasioned him to limp, and sometimes kept him for a few weeks confined to his room. In 1861, his medical man had requested him to take a Turkish bath two or three times a week, which he did, but desisted from after a short time, as each bath made him feel weaker and very faint for some hours. The baths had no effect on the pain. When I saw him, on January 13, 1862, he was in bed with a great tenderness over the sciatic nerve, and also down to the foot; the pain had almost prevented sleep for four days. Tongue coated; pulse sixty, weak; bowels not very free. I injected the one twenty-fifth of a grain of atropine beneath the skin. The pulse rose to seventy-two, beating strongly, and in seven minutes had sunk to sixty again. The leg was now warm and comfortable; the pain was relieved.

14th.—Has had no pain in the thigh or leg since the injection; he had *severe cramp* for a short time soon after the puncture, but slept well for the rest of the night. He can stand on one leg *without pain*.

15th.—Leg and thigh free from pain. Pulse sixty-four; slept well; a little pain in the loins; bowels open.

16th.—Can stamp his leg without pain; a little pain still in the loins, and I therefore repeated the puncture.

January, 1865.—Just three years have elapsed without this man having had a single return of the pain. He no longer walks lame, and continues his work, exposed to "all weathers."

CASE IV.—*Sciatica and ischio-dynia, apparently from a local cause*.—The following case is not one of sciatica, but an instance of severe pain, implicating a main trunk and some nerve branches, and which was relieved rapidly whilst the cause probably remained.

Mr. B——, of Brompton, aged forty, a man of active habit and small in stature, with a tendency to phthisis, had for some



years been subject to fistula. He came under my observation for pain and tenderness of the right thigh and leg, which had for three months been worse than before, causing him to stop and rest frequently whilst walking, and when in bed to turn with difficulty; the pain was also much complained of over and around the tuber-ischiü. The past and present existence of fistula and abscesses seemed best to account for the pain in these situations, and I was therefore the less sanguine of relieving the pain.

Sept. 30th, 1863.—I injected the forty-second part of a grain of atropine at bedtime: he was wakeful till near four a.m.; better in the morning.

October 2nd.—Slept well all night, and can turn easily in bed. He walked two miles with hardly any pain or need of rest.

5th.—Has walked five miles to-day, which has caused an extreme twinge or two of the pain from which the patient has been otherwise free. Rep. inject. hypoder.

6th.—Leg stronger and freer from pain.

January, 1864.—The pain and tenderness around the ischia and down the leg have not returned, although the disease around rectum has not otherwise mended. A large abscess which was pressing upon the greater sciatic foramen, having since required treatment, though hardly apparent beneath the buttock at the time when the puncture was employed to relieve the pain.

CASE V.—*Loss of Power and Morbid Sensibility of the Sciatic Nerve.*—The following case is one of less promise and of a different nature to the preceding.

A lady, aged sixty-three, came from the country to consult me for "sciatica," which had been gradually on the increase for eight or nine years. On examination of the case, it proved rather to be one of paralysis of the nerve than of sciatica. There was no real pain, but increased sensibility, and soreness in the bone, which caused her to walk slowly and stop occasionally. She limped from evident want of power in the leg. The general condition of the patient gave little chance of any permanent improvement. Not only was the heart weak and the pulse generally about 100 and irregular, but dyspnœa, swollen ankles, and varicose veins, showed the poor state of the circulation generally. There was no albumen in the urine, and no rheumatic history. The appetite was unusually good.

I employed a few atropine injections at intervals of three days with this result. That her power of walking became greater, her movements were more active, the limping less, the foot could be placed flat on the ground, and the soreness and uneasiness of thigh became less. The pulse in this patient was always increased to about 120 by the atropine.

CASE VI.—*Severe Rheumatic Pains in the Limbs.*—C. R.—,



a paper-hanger, aged thirty. This patient came in a cab to the Dispensary on the 7th of August, 1863, having once before had rheumatism, and having on this occasion been laid up with it for five weeks. He came slowly into the room by the aid of sticks, suffering much pain and loss of power, chiefly in the legs, thighs, and loins. On the average, he had lately had only two or three hours sleep at night. I injected the one-thirtieth of a grain of atropine and ordered an alkaline saline.

11th.—He walked comfortably into the room, and said the pains were nothing to what they had been, "they were frightful before the puncture," and had lasted for weeks. Pulse 120; tongue white; bowels open; he has slept better each night since the injection.

18th.—No pain at all; sleeps well; walks straight.

Oct. 1.—Discharged cured.

I must defer mention of cases of facial neuralgia for separate consideration, and for the present, briefly indicate the chief points apparent from the above cases.

1stly.—The great value of atropine as an internal therapeutical agent, and, 2ndly, its remarkable efficacy when employed hypodermically. For a long time I have prescribed atropine stomachically for similar diseases to those above given; in no case have I found such speedy, decided, or beneficial results to attend the stomachic as the hypodermic administration.

For five years, on the other hand, I have employed it by injection beneath the skin, and am daily the more convinced of the superior efficacy of this mode of its introduction into the system. If the one-sixtieth of a grain is considered a medium dose, and the thirtieth of a grain an inordinate stomachic dose, and one drop of a dilute solution upon the conjunctiva can produce poisonous symptoms, atropine is indeed an agent which requires extreme care when employed by subcutaneous injection. Neither is it a medicine to be used *indiscriminately*, otherwise severe sickness and giddiness, delirium, and muscular prostration may result; and this leads me to make a few remarks upon the preceding cases, which help to show us the action of the medicine and to indicate its use.

In the first three cases, which were all of sciatica, varying in duration from one and a half to five years, the atropine was superior in effect to the morphia. One patient had taken morphia daily for two years, and another, occasional doses by the mouth, and hypodermically, without curing the complaint. The atropine, on the other hand, seems to strike at the root of the disease; it does not act by temporally benumbing the sensitive or painful nerve, as some suppose, but it sets up a new and sudden tonic action in the nerve and comes like a newer and stronger tenant to expel the older and weaker one.



I have shown that the first effects of morphia and atropine upon the circulation are different; and so, also, are these secondary or tonic effects. The secondary or tonic effects of morphia are most especially on the cerebral ganglia; those of atropine upon the spinal and nerve conducting material.

Atropine, in properly regulated doses, is not a paralysing or weakening agent to the nerves, but it is so in excessive cases; and this I might bring forward as one reason for its administration by injection rather than by the mouth, by a plan that shows at once, with a minute dose, if the agent employed will benefit the case, rather than by the slow introduction of the medicine into the system by that less direct route—the alimentary canal. That there is a special action—call it alleviative, tonic, corrective, or what you will—seemed to be proved by the cases I have detailed. And why should it not have a special action upon these nerves, even as it has upon the iris?

See how in Case I., the pain disappeared, and the power that had been lost for two years daily increased,—how in Case II., the pain previously mitigated by morphia was temporally augmented to its original intensity for a short time, and then no more returned, which it always had done when only relieved by other treatment. Now, in Case III. a violent spasm shot down the leg, and eradicated the pain without the aid of any other medicine, which has never returned.

In the three first cases, the constitutional, or other effects than those upon the affected nerve, were well marked, and it may be argued that the great benefit that resulted was as much due to the sudden revulsion or shock that the system experienced from the introduction of the agent, as to any peculiar anti-neuralgic property of the atropine.

Allowing some beneficial action to be due to the shock, as discussed in a previous paper, still the atropine has undoubted properties, calculated to correct the morbidly sensitive nerve, even when it is by this plan introduced in doses too small to occasion any shock, or influence in an appreciable way, other or remote parts of the nervous system.

Thus, in Case IV. the patient felt no giddiness, nor even thirst nor dryness of the mouth; but the pain disappeared.

CASE VII.—In a case of facial neuralgia from pregnancy, the dose was too small to produce the characteristic atropine symptoms—much less a shock—but the pain of many weeks duration disappeared gradually during the twenty-four hours after the injection.

By the stomach, on the other hand, I believe atropine may be introduced into, and diffused through the system, together with the quinine mixture or other vehicle employed without its



*special* effects being equally well produced or observed, but with its disagreeable results on throat, &c.

But atropine itself, purely and simply introduced by the plan I am advocating, shows itself to be possessed of special powers of stimulation to many parts of the system—the skin, the throat, the iris, the vascular nervous system, and the spinal nerves, as is the case with the wourali.

And by virtue of this power of stimulation, it influences the sciatic nerve for good. It may first suddenly augment the pain, or cause the leg to glow with sudden heat, or cramp of the affected leg may quickly indicate the working of the drug; and then as quickly, these pass off, and ease from pain remains. They were the forerunners of the ease to come, they were the symptoms of nerve stimulation which precede the ultimate tonic effect.

Atropine is the goad that arouses the torpid nerve, and so gives power, as well as ease from pain; which morphia, though so efficient to relieve at once, seems less frequently than atropine thoroughly to eradicate.

*Tic Doloieux and Neuralgia.*—With regard to the beneficial effects of atropine in these painful affections, I must limit myself to very few words. Almost equally do the remarks that I have made as to the apparently specific action of atropine upon sciatica apply to its action upon these diseases. Whether the tic doloieux affects only *one point* or branch of a nerve—however severe the neuralgia may be in *one* part of the head, or face, or neck—I do not find localisation of the atropine injection to those painful parts necessary.

In these affections, if not produced by reflex irritation from acid in the stomach and other derangement of the digestive canal, in which cases aperients, alkalies, antacids, &c., should first be had recourse to; but due to causes producing exhaustion of the nervous system, such as great heat or cold, or alternations of temperature, or exposure to wet or to cold winds; the specific effect, as I venture to call it, of atropine, is often as marked in these affections as it is in cases of sciatica.—(See Appendix.)



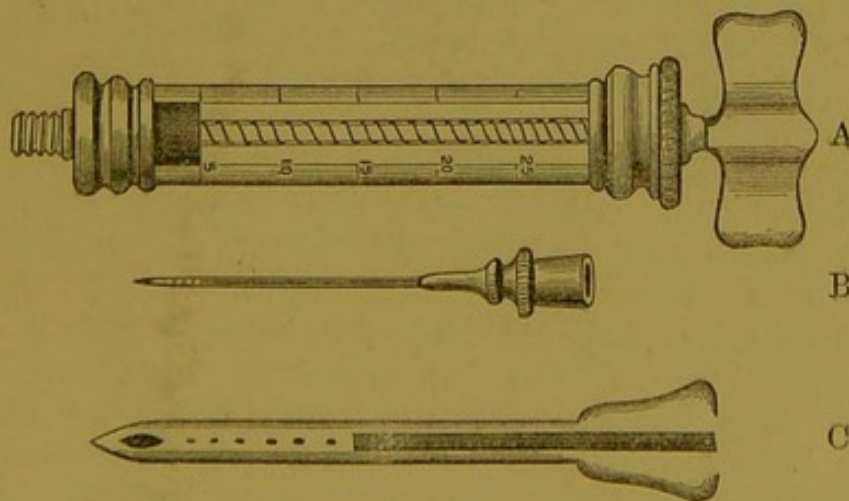
## CHAPTER VI.

### ON THE MODE OF EMPLOYING THE HYPODERMIC TREATMENT.\*

*The Syringe.—Its Employment.—The Tissues and Parts of the Body to Inject.—The Quantity of Fluid to Inject.—Cautions Concerning Dose.—Greater Effect on Women than Men.—The Value of these Injections to Test the Action of Alkaloids.—Sleep not a Necessary Result.—The Occasional Sickness.—Its Cause.—Choice of Cases.—Choice of Agent.—Is Chloroform Applicable for Hypodermic Injection?—Lingual and Rectal Administration Compared with the Hypodermic.—General Conclusions arrived at.*

I PROCEED now, in accordance with the wishes of many, to make a few remarks on the practical application of this method.

*The Syringe for Injection.*—The little instrument I use is made by Messrs. Whicker and Blaise, it is of the same make (but a little larger as regards the barrel) as their original *caustic syringe*. The barrel is of glass, with silver fittings, and contains a piston which works by a screw-rod, each half-turn of which expels half-a-minim, as a fine drop from the end of the pipe.



A.—Hypodermic syringe, as made for author.  
B.—One of the gold tubular perforating needles,  
C.—Enlarged view of B.

\* The bulk of the observations contained in this chapter were made in two communications to the *Medical Times and Gazette* in 1859.



Two pipes belong to each syringe, the one larger and stronger than the other; the one here figured A is drawn the exact size of the smaller pipe, which will be found the best for general use; it screws on and off the barrel at pleasure, and is made of silver, with a hardened gold point. This point is sharp, like a needle, and perforated on one side (as shown in the enlarged view, C) by the oblique opening through which the drops of the narcotic or other solution, are expelled.

*No incision is required* with lancet, or other instrument, when this syringe is used, for the point of the pipe being very sharp and fine, is readily passed, with proper precaution, beneath the skin; no blood is shed, and the operation is no more than the prick of a needle.

*The Employment of the Syringe.*—Having charged the syringe with the narcotic fluid, hold it in the right hand at the junction of the barrel with the pipe, and with the left hand take up, between the finger and thumb, a fold of the skin of the patient, so as to make tense the part beyond your thumb, then the right hand being gently steadied, but not heavily pressed on the patient, let the point of the syringe, which is held at a right angle to the skin, touch the part which is tense, and, with a *quick but steady movement*, be passed through it; the point being well *through the skin*, the direction of the pipe may be altered so that it may run along in the loose cellular tissue beneath; \* all this is the work of a moment; the pre-arranged number of drops are then introduced by so many turns of the piston, the pipe is then withdrawn, a finger making slight pressure as near as possible on the punctured spot, the object being both to steady the skin and prevent any drop of liquid escaping; and lastly, a narrow strip of plaster cut beforehand and warmed, is placed on the spot.

The strip of plaster is generally a precautionary measure, but it becomes a necessity when the quantity injected is large, say twenty minims; but it is always useful to prevent the spot from being chafed. A broad piece of plaster is worse than none at all, it presses on the "little lump" which is caused for a few minutes by the presence of the injected fluid beneath the skin, and not at all perhaps on the punctured spot, and so it does more to press the fluid out than keep it in (I have seen a first injection in a case of delirium tremens fail for this very reason); *but a narrow strip just covers the punctured spot.*

These directions may appear unnecessary, but the operation may fail, as just shown, for want of attention to these little

\* In the majority of cases the plan above described is best, especially with thin people; if, however, the patient is very fat, it is better to perforate vertically a portion of skin and subjacent fat, pinched up, and so made tense between the finger and thumb.



points. If the introduction of the syringe be attempted, the skin of the patient being loose, or the syringe held at the further end, and consequently unsteadily, the patient may by these means be put to a great deal of pain, and the pipe of the syringe may be bent or broken from the socket ; but when it is introduced with a quick steady movement, the skin being tense, the patient does frequently not even know when the point is introduced.

*The Tissue to Inject.*—The tissue injected is the cellular or areolar tissue of the body ; it may not matter *much* whether the cellulo-adipose tissue, the panniculus adiposus, or the reticular tissue beneath it (not containing fat) be injected, but the latter is to be preferred ; it is the looser of the two, fluid injected into it meets with no obstruction, and cannot easily escape from it, but if injected into the skin itself, as some think it is, or the conjoined cellulo-adipose tissue, it is apt to cause pain, it enters less readily, and is more apt to escape ; nor does it seem to act quite so rapidly as when injected into the loose cellular tissue from which most probably absorption is the more rapid.

*The Part of the Body to Inject.*—When the object is to quiet the brain, or to produce a general effect, is it material whether the fluid be injected into the cellular tissue of the body or of an extremity ? *No* ; the non-necessity of localisation is the basis of this plan of treatment, and is the reason of its applicability in cerebro-spinal affections and general diseases. I need only refer to the various cases detailed in corroboration of this. The site which I, however, most commonly inject is *the inner part of the arm*. The skin is here thin, easily made tense, and easily perforated ; the cellular tissue beneath is loose, and readily receives the fluid ; there are, perhaps, more veins here than in some other parts, but they are easily avoided. For injection over the abdominal parietes or in the dorsal region, the larger pipe must be used on account of the greater resistance offered by the skin.

*The Quantity of Fluid to Inject.*—It is as well to have the fluid of that strength that three or four turns of the piston shall be an ordinary injecting dose. Two or three turns can be made in a moment of time, and it is no small relief or surprise to the patient who has been expecting, perhaps dreading, an operation, to find it all over in *less than half a minute*.

*The Dose.*—Too much caution cannot be employed with regard to the *amount of the narcotic* injected. Two half turns, if your solution is strong, may double the dose, and the life of the patient, for want of due care, be placed in jeopardy ; I would, therefore, urge attention to these points :—



1. Be certain of the exact strength of the fluid employed, and the exact value of each turn of the piston.

2. Concerning first injections, never use more than half the ordinary stomachic doses for males, nor more than a third for females.

3. Should a second injection be necessary, let it not be used too soon, nor in a full dose when the patient is partly under the influence of the narcotic.

These points are of practical importance, a *certain degree* of narcotism has to be reached for benefit to accrue, and by the injection it can be reached in many cases by a very small quantity of the narcotic, because of the rapidity with which the effect is produced, what we have to avoid is *too great* an effect; what we try to produce is a *certain effect* with as *small a quantity* as possible. This leads me to remark that men bear narcotics much better than women.

I was not aware to what extent this was the case until I had employed this treatment some little while; but I now think it may be looked on as a rule, that men in general will bear with no ill-effects, but be benefited by, injected doses of narcotics, which doses would very strongly, if not seriously, affect women; *this treatment is a test of the exact amount* of a narcotic necessary to produce a desired effect, when taken by direct means into the general circulation. For instance, you introduce beneath the skin the one-eighth of a grain of morphia, the effect which follows is the whole effect of the whole one-eighth; but you cannot be certain that the effect which follows the administration of one-eighth of a grain, firstly, by the skin; secondly, by the stomach; or, thirdly, by the rectum is the effect of the whole one-eighth, but it is the whole effect of the quantity actually absorbed.

As by this method we get the *whole effect of the known quantity introduced*, which we are not sure of getting by the other modes, we have now a means as accurate as that of venous injection (without its dangers) for testing the precise effect of little-known medicines on animals, and the exact doses and effects of well-known medicines on man, of seeing the difference which the sex requires in the dose, and of ascertaining the minimum amount required to produce a desired effect.

It is impossible to say "what amount is to be injected" without knowing the particulars of the case as well as the sex and age; but taking the acetate of morphia for an example, I think that first injections for adult females should vary from the one-eighth to a quarter or one-third of a grain; for adult males, from the one-sixth to half or three-quarters of a grain.

First injections should be small rather than large, and are good indicators of the amount necessary, should repetition be



required. It is true that I have seen used and employed myself much larger quantities than those I have mentioned, for first injections; but the cases have been exceptional, and under close observation.

*With regard to the sleep* occasioned by the injection, it must not be looked on as a necessary effect of the treatment, it may follow at once, after a time, or not at all, according to circumstances. Thus it may follow—*At once*, if the quantity injected is large, and the object is less to ease pain than to procure sleep. *After a time*, if the quantity is large (say one grain of morphia), and much pain exists; in which case the pain is generally quieted directly, and sleep follows in from fifteen to thirty minutes. *Not at all*, when the quantity injected is small, and there is much pain, spasm, or cerebral excitement going on, in which cases, as the quantity is small, the whole effect of the narcotic is expended either in subduing the pain and spasm, or allaying the excitement.

*The Occasional Sickness.*—In the fifteen cases, sickness occurred in only two. In one it was distressing, in the other but very slight.

In another series of fifteen cases, of which I have notes, sickness occurred in four. In one it was considerable, and in the others to no extent.

Consequently in thirty cases only two patients, both of them women of very nervous temperament, and both suffering from tic-doloureux, had considerable sickness; in the other four, all men, with sciatica, the sickness was trifling; in fact, the patients themselves thought nothing of it, nor did they think it due to the injection. This cannot be called a large proportion, when it is recollected how often morphia causes sickness when given by the stomach; I have constantly seen it from a quarter of a grain, and from laudanum in equivalent doses, cause sickness, so administered.

The time when the sickness comes on varies; in the two cases in which it was severe, giddiness and nausea were felt almost immediately, then faintness, till in about five minutes sickness took place; in both it continued on and off for several hours, with intervals of sleep. In the four other patients, the sickness did not come on for many hours, in fact, only as a kind of ultimate effect of the morphia after a good sleep.

*Cause of the Sickness.*—From the preceding remarks it appears that sickness may be looked on as either a first, or as a last, effect of the narcotic. That when a last effect, it is but trifling, coming on after many hours' sleep, preceded for a little

\* These cases were given in the subsequent papers of the series, in the *Medical Times and Gazette*.



while by nausea, and disappearing generally after the patient has been once or twice sick, with scarcely a straining effort. A slight excess of the narcotic may be looked on as the cause of this sickness. But in both the cases in which the sickness was urgent, the patients, *both* women, besides being, as above stated, highly nervous, were both badly affected by narcotics, however administered; in both, the quantity injected was *less* than was employed in the cases *where slight sickness* ensued, and in many cases where none at all took place,—in the one less than a third of a grain, and in the other a little more than half, was the quantity injected. The *cause* of the sickness in these two cases, as it was so immediate, seems to have been due rather to a peculiarity in the constitution of the patients, than to the amount of the narcotic employed.\*

Ought the occasional occurrence of severe sickness to cause the injection of remedies to fall into disuse? I think certainly no more than it ought the introduction of narcotics in *other ways*, because sickness occasionally follows *their* administration. But as medicines, hypodermically introduced, act with greater rapidity and effect than when administered by other methods, it behoves us to be the more careful in the selection of *proper cases*; and where it is desirable to employ the treatment in such cases as the two where sickness occurred *directly*, to inject a *much smaller quantity than usual*; for it is not improbable that in those two cases, as benefit resulted in both, that a still smaller quantity would have sufficed.†

*The Choice of Cases.*—This plan of treatment is no specific; because it acts marvellously in some cases of neuralgia, or of pain, is no reason why it should cure all. For this reason, *a due discrimination of cases ought to be made*. The same caution is given by Dr. Wood in his paper on the treatment of neuralgia by *local* narcotic injections:—"Another caution I would offer is, that you choose the proper patient for the use of the remedy."‡ When to employ the injection, and when not, must

\* Whilst allowing that sickness does follow the injection of morphia in exceptional cases, we must not overlook the value of injected morphia in *sickness* and even *severe vomiting* from derangement of the stomach *from other causes*. It will also postpone, if not prevent, the sickness induced by chloroform, according to the experience of Mr. C. H. Moore, in surgical operations. 1865.

† "Recent Observations on Sickness."

‡ My object in alluding to this passage (*British Medical Journal*, August, 1858) is this,—that as I do not find localisation to the painful part necessary, my plan is available in many *diseases* in which that of Dr. Wood is not—as mania, delirium tremens, &c. It is also applicable in some cases of pain and of neuralgia in which Dr. Wood's cannot be—viz., those in which the nerve cannot be reached for injection. There is, therefore, a greater need of caution to discriminate proper cases where the range is *wider*, than where it is more limited.



depend in the general way on the particular circumstances of each individual case, such as the nature of the disease, its urgency, the object in view, &c.

There are some cases in which I think the hypodermic injection may almost be employed *as a rule*, and be put in force *before the time was lost* by the adoption of other measures. I mean those cases of high cerebral excitement, of delirium tremens, and of mania, in which the speedy administration of a narcotic is indicated. In this class of cases more than any other the value of the injection is seen. I have already detailed *seven* cases of this nature, and could give many more, but there hardly seems the necessity. In these cases, to procure sleep and allay excitement is the object, and that as soon as possible; the stomach is often irritable, or in such a state that it will not absorb medicines; the patients often refuse to swallow (as in Mr. Cutler's case); everything, in fact, points to the necessity of some more sure, speedy, and active mode of treatment than the more ordinary one of stomachic administration.

There are cases of sudden, violent, acute pain, in which the injection might also be tried as a *primary measure*; for instance, during the passage of a renal calculus, in such a case the pain is at times almost insupportable, and as the stomach gets quickly irritable, sickness often taking place, another reason is furnished for the trial of this plan.

Then there are cases in which the injection ought not to be tried at first, but after such general treatment as is clearly indicated has been first tried—such as purging, or the internal administration of alteratives or tonics. Tic-doloureux, sciatica, and many other neuralgic affections are of this class. In all such cases, due discrimination being made, it is astonishing what benefit follows the injection in most cases, and how quickly in many, a cure is effected by it when other treatment has altogether failed. It is often, too, in those cases the origin of which is most obscure, that the injection seems to answer best.

Rheumatism is a disease in which occasionally the use of the injection into the cellular tissue will be found highly serviceable. Two cases have been treated by it at St. George's Hospital:

1. (*Case 16.*) Under Dr. Page, a man almost crippled by rheumatism, had the pain greatly mitigated by the injection.

2. (*Case 17.*) Under Dr. Pitman, a man that could not move his arm after acute rheumatism on account of pain in the shoulder. The pain was removed by a single injection.

3. (*Case 18.*) A gentleman under my own care, who suffered acute pain in the shoulder and arm which prevented his moving the limb and sleeping at night. It was removed after a few injections.



There are many diseases in which the pain accompanying them must be looked on, not as the essence, but as a *very important* item, which keeps us the disease and which prevents treatment doing any good, but which, once subdued, then the inflammation or whatever the case is, rapidly becomes influenced by the treatment which it had up till then resisted. In such diseases the injection may do much, and that speedily, and certainly deserves a trial.

CASE XIX.—The following is a case where the patient, having a peculiar destructive inflammation of both eyes, suffered almost uncontrollable pain, which was unexpectedly cured by the hypodermic injection:—

T. B., aged 41, was admitted April 12, 1859, into St. George's Hospital, under the care of Mr. Tatum. For the first three weeks he suffered acutely, the conjunctiva of both eyes was greatly chemosed, red, and tender; for the greater part of this time, he *seldom closed his eyes day or night*. Notwithstanding leeches, blisters, calomel, and opium, and finally, morphia, a quarter of a grain every three hours, were employed. The injection of half-a-grain of morphia into the arm was then tried; it eased him for some hours, but did not cause sleep. Two days after, the injection was again employed, one grain being used this time. The patient describes the effect of the injection "as something which instantaneously ran through his frame, round his head, and which seemed to go out of the back of it." *The pain was gone*, and he slept in about ten minutes. The sleep lasted six or seven hours. The patient went out about three weeks after the second injection, during which time he had no more pain, and slept well every night.

Thus, there are cases where this treatment may be employed, and, as shown above, with the greatest advantage—1. As a primary measure, at the onset of the disease, without delay; 2. As a secondary measure, general treatment being first used; and, 3. As an ultimate measure, to attempt to palliate or cure, where other treatment has failed.

*The Choice of a Narcotic.*—This must depend entirely on circumstances, such as the sex, the peculiarities of the patient, the disease, and the object in view. It is not my intention here to go into these points, as they require *almost* equal consideration before the administration of a narcotic by any method, but rather to indicate in this place the *most eligible preparations for injection*.

*Tinctures* may, and can be, used with good effect. Thus, Mr. Burns used equal parts of the tinctures of opium and hyoscyamus.\* I have employed both these tinctures separately, and

\* *Medical Times and Gazette*, October 16, 1858.



have found this objection to them, that they cause a little hard lump beneath the skin, which *may* last a considerable time, but which gradually disappears if left quiet, and alone. There is not this objection if the tincture be evaporated to one-half or one-third, and be used while it is fresh.

Dr. Wood has used a solution of morphia in sherry wine as "it would not irritate and smart so much as alcohol." He also says that "nepenthe" produces less sickness than opium, and is therefore preferable as an injection.\* Professor Simpson has used a *solution* of the bimeconate of morphia in coccodynia.† I have injected Squire's solution of the bimeconate of morphia with great relief in many cases. It is more suited to relieve pain and want of sleep in women, than it is to cut short delirium or mania in the male.

For my own part. I *prefer solutions* of the alkaloids to *tinctures*; they are rapidly absorbed, they produce no irritation if properly made, and they have this advantage—viz., of exactness, so that no mistake need be made about the strength of the preparations, or the quantity injected.

A solution of the acetate of morphia is the preparation I have used more than any other, prepared with acetic acid, but so freed from excess of that agent that it causes not the least irritation.‡ Mr. Williams, of Liverpool, who has tried the narcotic injection in delirium tremens, has proposed to me the employment of the sulphate of morphia on account of its ready solubility.

A solution of the sulphate of atropine is a good preparation for injection, and not liable to irritate. I have several times employed it, and produced sound *sleep* with doses varying from the 1-25th to the 1-10th of a grain, in some neuralgic cases, but these doses are too large as a rule, as elsewhere shown in these pages.

*Is Chloroform applicable for Hypodermic Injection?*—Chloroform is a narcotic which may be, with safety, injected into the cellular tissue in *urgent* cases; it rapidly produces cessation of spasm, and causes sleep.

In numerous experiments which I have made with this narcotic on animals, I find that the effect on rabbits, when injected in small quantities, is somewhat analogous to that of opium in small doses, but in larger is more productive of anæsthesia than of coma. Thus in

*Experiment 1.*—Ten minims caused temporary protrusion and congestion of the eyes for a minute or two, but no anæsthesia.

*Experiment 2.*—Fifteen minims caused it to become unusually

\* *British Medical Journal*, August, 1858.

† *Medical Times and Gazette*, July 1859.

‡ *Ibid*, March 26, 1859. Strength, twelve grains to one drachm.



quiet in three minutes. Gradual relaxation of the muscles till it was prostrate in *eight* minutes. Brain clear, no anæsthesia. The effect went off in from fifteen to twenty minutes.

*Experiment 3.*—Thirty minims caused excitement for a minute or so, muscles began to relax in three minutes; no decided anæsthesia, but sensibility dull, and the animal inclined to sleep. Effect over in thirty minutes.

*Experiment 4.*—Forty minims caused general excitement in *one* minute; anæsthesia commenced in *two* minutes, and considerable muscular relaxation in *three*, in *five* it was anæsthetic, and the muscles relaxed. The animal was for the most part completely anæsthetic for the space of an hour, during which time any operation could have been performed unfelt by the animal. At the end of the hour the effects gradually went off, leaving no bad result.

From these experiments it is manifest that—firstly, not only was the effect proportionate to the dose; but, secondly, that the *stronger* the dose the more *quickly* was anæsthesia produced; it is, thirdly, to be observed, that there was not the least subsequent bad effect, either locally or constitutionally.

Bearing in mind these results, and having a patient suffering frightfully from neuralgia of years' duration, on whom all ordinary medicine was lost, I was tempted to endeavour to give him sleep and relief from spasm for a time by the injection of chloroform. Although accustomed for years to inhale, and even swallow, enormous quantities of that agent, and to take other narcotics in similarly large doses, the first injection of ℥xxx. of chloroform, slowly introduced, caused almost instant quiet of spasm, and sleep in fourteen minutes. The injection of chloroform was several times repeated at intervals, at the urgent request of the patient, who each time obtained considerable relief from it. I left it off, however, on account of the local symptoms, which took place at some, but *not all*, of the places injected; and because of these local effects, I think the injection of chloroform is *not to be recommended* for the human subject. These local effects were—firstly, pain at the moment of injection; secondly, in a few minutes the skin of the part injected became of a bright red colour, elevated, and tender to the touch; and giving, thirdly, for a short time, the feeling of crepitus. At the end of twenty-four hours all these symptoms disappeared, the swelling going away, and the redness being replaced by a brown stain like a macula. From ten to fifteen days after, nothing was to be seen or felt, although a sensation of tenderness or pain was still experienced in the part by the patient, *but no abscess resulted at any point.*

In the preceding papers on this subject I have shown the advantages of this mode of treatment over the endermic, enepi-



dermic, and stomachic methods, which, requiring longer to act, are less certain and apt to fail completely. Before, however, bringing this paper to a close, I would allude to two other modes of medicinal administration—viz., by the tongue, and by the rectum.

1. *Medicines administered by the Tongue.*—Dr. Wardrop has shown\* that there is a remarkable difference in point of time when medicines are absorbed from the stomach or from the mouth, absorption being most rapid from the latter, and the effect is more regular and more equable. Nor is it difficult to see why,—the medicine absorbed from the mouth is taken directly into the general circulation, but when absorbed from the stomach it has *en route* to pass through the portal system; absorbed from the tongue, the effect is more regular, because the medicine is more certainly absorbed *en masse*.

There is, then, much similarity between the hypodermic and the lingual modes. Rapidity of absorption is the great point in the *modus operandi* of each; and, with regard to the effect, they both have the advantages of rapidity, greater efficacy, regularity, and equability. Can the one method, then, replace the other? Are they applicable for the same cases and medicines? No; they both have their advantages. Dr. Wardrop's plan is best for the administration of *tasteless* medicines, for calomel, *et hoc genus omne*, but it cannot be used for those medicines which are nauseating and bitter; not, in fact, for narcotics generally, not for cases of delirium, patients refusing medicine, &c., which are the cases where the other plan is most desirable.

2. *Medicines administered by the Rectum.*—This mode of medicinal administration is of great value, and useful as a means both for local and general treatment; there can be no doubt that this method has advantages which the stomachic has not—viz., of greater rapidity of action and greater effect, but the effect is *uncertain*; this uncertainty of action is *not* dependent on the mode of introduction, especially if the medicine be used in the liquid form, and employment be made of the graduated syringe invented by Mr. Spencer Wells to regulate the exact amount introduced; but is due to the want of *regularity of complete absorption*, which cannot be done away with. The rectal method is the more advantageous where the object is to administer the smaller doses of narcotics for affections of the intestinal canal, the rectum, and the parts adjacent supplied by the great sympathetic, but *most especially* for the speedy introduction of stimuli, and of nutriment in urgent cases, for liquids introduced by this plan have the advantage of being conveyed *simultaneously* into both the portal and systemic circulation;

\* Ranking's Half-yearly Abstract, vol. xxii., p. 302.



the hypodermic, on the other hand, is the more applicable for those cases where the part requiring the narcotic is supplied by the systemic circulation, and is under the influence of the cerebro-spinal nervous system.\*

On the 10th of June, 1865, I remarked in the same journal:—"In your number for Oct. 8, 1859, I even gave the preference to the rectal method in certain cases over the hypodermic. My subsequent more extended use of the latter plan in intestinal cases, as of obstruction, of ileus, of enteritis, colic, &c., inclines me to withdraw that preference, so quickly and effectually have I since found the relief afforded in such cases by the injection of the anodyne in the arm, the thigh, or over the abdominal parietes; besides delay of effect is scarcely probable, whilst it is more than probable, from different causes, by the rectal method, and has occurred, as Dr. Stewart's case of belladonna-absorption showed."

Leaving for the present the consideration of the *modus operandi* of this plan of treatment, we may, partly from the experiments on animals, but *chiefly* from the cases just reviewed, sum up with the following *practical conclusions*:—

1. That certain medicines may be introduced into the cellular tissue beneath the skin with safety and with advantage.

2. That medicines so introduced have a *general* as well as a local effect.

3. That the general effect of medicine so introduced is exceedingly rapid.

4. That this mode of administration is *more certain in its action* than is the action of a stomachic dose; for the *exact* amount introduced is known, and the whole of it takes effect, which *may* or *may not* be the case with stomachic doses, which may, on the other hand, be retained unabsorbed, vomited, &c.

5. It is also, and for the same reason, a more trustworthy method for certainty of the action of a remedy, than are the endermic, enepidermic, lingual, and rectal methods.

6. Medicines are *more purely received* into the system by this method than when given by the stomach, in which organ they may become contaminated or decomposed.

7. A given amount of a medicine employed hypodermically has greater effect upon the system than the *same* amount administered by the stomach.

8. Medicines are *more rapidly absorbed* into the system when thus administered than by the stomach. The desired effect is therefore *more quickly gained*.

9. A given amount of medicine employed hypodermically

\* The above appeared in the *Medical Times and Gazette*, of October 8 1859.



has a greater and more rapid distant effect than when employed *endermically*, *enepidermically*, or *ratraleptically*.

10. That the medicines for which this mode of introduction is especially applicable are the various *narcotics* and *sedatives*, *hypnotics*, and *nerve-tonics*.

11. That this plan of treatment is more especially indicated for the relief of *affections of the nervous system* :—

1stly. Where the immediate and decided effect of the medicine is required.

2ndly. Where medicines administered by the usual methods fail to do good.

3rdly. Where the effect of a medicine is required, and the patient *refuses to swallow*.

4thly. Where from irritability of the stomach or other cause (such as *idiosyncrasy*, &c.), the patient cannot take the medicine by the stomach.

12. That to produce a general effect it does not signify whether the remedy be injected into the cellular tissue of the body or of an extremity.

13. That to relieve or cure a local neuralgic affection there is no necessity to localise the injection.

14. That whether the object be to treat a local or general affection, it seems advisable each time to change the site for injection, should it be more than once required.

15. That this mode of introducing medicines is the most accurate one we possess for *testing their true action* upon the system generally.

16. That *antidotes* to certain poisons can by this mode be rapidly introduced into the system.



## CHAPTER VII.

### *Morphia as a Tonic in certain conditions of the Nervous System.*

THE remarks in this chapter formed a portion of a paper read at the Royal Medical and Chirurgical Society, on the 23rd of May, entitled "The Hypodermic Administration of Certain Medicines." The chief object of that paper was to bring forward for discussion my view that for the treatment of certain affections of the nervous system, the Hypodermic administration of certain alkaloids is more beneficial than the stomachic as regards :—

1. Rapidity of effect.
2. Purity of effect.
3. Certainty of effect.
4. Greater permanence of curative effect.
5. Avoidance of exhaustion.

The abstract of this paper and the discussion that ensued will be found in the *Medical Times and Gazette* of June 3, 1865.

"In conclusion, I would allude to the *tonic* effect of agents hypodermically injected. I believe many tonics may be thus given with advantage, when they cannot be given stomachically. Quinine, for example, may cause headache, or be rejected by the stomach, but cause neither headache nor sickness when given by the cellular tissue. For the administration of ordinary tonics by this method the cases must, as a rule, be exceptional ones.

"As a nervine tonic, I propose morphia by this plan, and must limit myself to only a few general remarks. I have frequently used this alkaloid, not as an anodyne, not as an hypnotic, not for the relief of spasm, but to remove cerebral nervous debility—in cases in which the brain has, from various causes, been overworked—the nervous system overtaxed, and in which inaptitude for work, restlessness, irritability, loss of appetite, and general prostration have been such as to prevent the patient from following his profession or business. In such cases I hold that morphia does produce a tonic effect upon the nervous system, and when given by the cellular tissue, it is more essentially tonic than when given by the stomach. Sleep need



not be the result of the puncture, but the normal state and vigour of the nervous system are restored.

What is a tonic? "A tonic is a substance giving vigour to a debilitated system, through causing a more healthy condition of its structures, not by supplying material for the structures, but by exciting actions in it, conducing to a more perfect assimilation of material by it." \* As such I believe the action of morphia often is in the class of cases I have just alluded to; that action which Pereira calls "alterative" must be regarded as his nearest approach to a definition of this effect upon the brain. The numerous authorities he quotes as to the action of opium on the nervous system seem divided between those who say it is a stimulant, those who say it is a sedative, and those who say it is both; none apparently regarding it as a tonic.

In cases, however, of the following description, the action of injected morphia is *modified by the existing disease*. It acts neither as a stimulant, nor a sedative, nor as a narcotic; it produces neither excitement, depression, nor sleep, but it restores the equilibrium of the nervous system:—

A gentleman, about seventy years of age, holding a government appointment of considerable responsibility, has at times become unequal to his work, partly from some stress of business on hand, partly from an over anxious temperament, anxiety about his duty, and mental disquietude from other and trying circumstances.

The above-mentioned symptoms of inaptitude for work, symptoms of nervous exhaustion, come on; and owing to the excessive vigilance of his brain, great restlessness, and, perhaps absence of sleep for many a night together would be the result, unless this state was checked at the onset.

The various forms of opium and morphia, given by *the mouth*, fail to do this except in the course of time, and when so given derange the stomach and bowels, causing flatulence, &c.

The injected morphia, on the other hand, quickly removes these distressing symptoms, not by confusing the brain and giving sleep, but by clearing the brain "of its cobwebs," by reducing the excited pulse of 100 to the normal pulse of eighty, or even to sixty, for a few hours. The morphia may be injected *after breakfast*, at a time when the patient is apparently unfit for any head-work, but he will very shortly begin, and complete a good day's work. He does not sleep or wish to sleep till night. If given at night, the injected morphia will clear the brain, remove disquietude, perhaps give sleep, as often not, but even keep the patient awake "in a calm state of dreamy dozing,"

\* *Popular Science Review*, "What is a Tonic?" By E. Divers, Esq., of Birmingham.



which has the equivalent effect of good sleep upon him as regards his next day's work.

Take another class of case. In *mania à potu* and in *delirium tremens* I have even used the puncture, with morphia, so to steady and quiet the brain and nerves of the patient, as to enable him in a few minutes to walk to his office, and go through his duties. In the drunkard as in the overtaxed and melancholic case, there is great mental excitement, worry, anxiety, and insomnia. The stomachic anodyne will constantly fail to produce any effect, but the Hypodermic dose, even where it fails to give sleep, will almost invariably remove or abate the anxiety, the restlessness, and the nervous irritability, which are the states leading to exhaustion and unfitness for work.

Whilst producing these purer effects upon the brain, it is no small point that, in *these* cases especially, the bowels are not constipated, nor the action of the liver interfered with, as usually occurs when the same dose is given by the mouth.

*The tonic effect upon the spinal marrow and its nerves.*—As upon the brain, these effects are purer and more natural in their mode of operation by the cellular tissue than by the stomach. In sciatica, for instance, I have said that I believe *greater permanence of effect* will follow the hypodermic than other modes of giving the same drug. The greater permanence of effect when cases have been cured by this plan, and by a comparatively small number of these medicinal applications, shows that something more than the mere anodyne influence has been at work.

Sciatica is *more* than simple pain of the nerve; although a case may be of years' standing, a single puncture with morphia or atropine may relieve all the pain, but the stiffness, the lameness, the deficient nutrition remain for some time. The repetition of the injection will restore power or tone; and if three or four injections are used where these symptoms remain, after the pain is removed in long-standing cases, the patients will often say they feel more power return with each injection. Stomachic doses do not produce these tonic effects so strikingly.



## APPENDIX.

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CASE 1.—*Tic Dolozeux*; or acute facial neuralgia, treated by the *distant* injection of the curative agent.

This is a well-marked instance of a case of this disease in which the agent injected seemed to strike at once at the root of the disease, and to check that which previous treatment had failed to influence.

Mr. C——, head groom to Mr. G. D., a robust, healthy-looking man, temperate and regular in his habits, sent for me on the 1st of May, 1864, at nine p.m. He had been in agony for fifty-five hours without cessation; the pain, which was of a constant throbbing nature, was situated on the left side of the face and head. No sleep for two nights. Bowels open by medicine; had taken several doses of quinine without any relief; teeth sound; pulse 90; circulation excited, and the face swollen from the pain. I injected into the cellular tissue *of the arm* one-thirtieth of a grain of the sulphate of atropine at nine p.m.

May 2nd.—It immediately removed the pain, and he slept till one a.m. the next morning; the pain then returned rather severely for a short time, but it was now *localized to one spot*, just in front of the ear, instead of, as previous to the puncture, involving the whole cheek, forehead, and left side of the head. Nine p.m.—Head and skin cool; pulse 80; no pain. I refused to inject as he desired, there being no pain.

3rd.—Severe pain for a short time in the night. Rep. inj. hypod. 7.30 p.m., into the cellular tissue of the *arm*.

4th.—The pain gradually died out in the course of two hours.

May 3rd, 1865.—This patient has not had a single twinge of pain from that time to this. The puncture seems completely to have *toned* the nerve, for during the hunting season of 1863 he was constantly suffering slight pains whenever he entered a warm or hot room out of the cold air. This season he has never had a twinge. Let it be allowed that the rapid recovery might once have been wrongly attributed to the injection of atropine, especially as that injection was made *at a distance* from the affected part; but the proof that the atropine *did specifically* effect the cure, has just been furnished.

July 21st, 1865.—The tic has again attacked him, possibly brought on by the excessive heat. This time the *right* side of the face has been attacked. One can hardly, therefore, say that this is the old attack uncured. The pain had been very severe for some hours when he came to me. I injected the one-thirtieth of a grain of atropine into the *arm*. For three hours the special atropine symptoms mani-



fested themselves ; but the pain left him about an hour after the injection.

August 21st.—There has not been the slightest return during the last thirty days of the pain, which seems as completely removed by the *single* injection, as it was more than a year ago, by the two injections.

Cases III. and IV. at page 12, and Case 1 in the Appendix, are only instances of many that lead me to conclude :—1. That many cases which have for weeks resisted the usual remedies, such as purging, quinine, anodynes by the mouth, &c., can be at *once cured* by the atropine injection. 2. That the atropine thus administered—without medicine being given at the same time any other way—will specifically eradicate the pain, which rapidly abates and disappears in most cases *during* the persistence of the other characteristic atropine phenomena. 3. How in many cases that have now remained cured for some *years*, the alkaloid was injected into the loose cellular tissue *at a distance* from the neuralgic site.

CASE 2.—*Mania à potu* ; treated by the morphia injection.

November 23rd, 1863.—O. J——, an inveterate drinker, found his way home to-day after wandering about the streets for five or six days ; has been incessantly drinking gin and beer during that time ; does not think he has slept for several nights. 3.30 p.m.—Was sitting up talking, barely coherently ; skin hot ; eyes very red and feretty ; head hot ; not perspiring ; tongue covered with a thick, creamy-white fur ; edges of tongue red ; breath very offensive ; pulse 100 ; regular, full, tremulous.

I injected the three-eighths of a grain of the acetate of morphia into his arm, and had him put to bed. He dropped asleep in ten minutes for a quarter of an hour, and then awoke, as he usually did, with a few violent jerks.

24th.—He slept for some hours, and was only violent once in the night, and that for a very short period (the male attendant, who had been with him in previous attacks, had never seen him quieted so quickly or effectually). Pulse 80 ; limbs more steady ; bowels open ; tongue cleaner ; brain more under control, but still he keeps relating fallacies. Rep. inj. hypo.  $\frac{7}{8}$  grain.

25th.—The pulse was lowered from 80 to 64, in ten minutes, by the injection. Pulse 72 to-day ; brain, much steadier ; tongue cleaner and much steadier ; a little sleep in the night ; two aperient pills ordered. Rep. inj. hypo., with same result on the pulse.

26th.—Quite quiet and rational ; tongue already nearly clean and quite steady ; bowels open ; had a good quiet night and

27th.—Went to-day, as steady as possible, to his office, a Government appointment.

This patient has these attacks from time to time, at intervals perhaps of some months. Sometimes he is so wild and violent that restraint is necessary until he has had a morphia puncture which rapidly allays the cerebral excitement.

The preceding case shows the value of morphia in speedily restoring the natural functions of the brain, it shows that, *sleep once induced*, the neck of the disease is broken, and nerve power is then



all that is required. I believe, in cases of this description, that the occasional repetition of the injection gives that nerve power, and it does so without always inducing sleep.

CASE 3.—*The Tonic Effects of Hypodermically Injected Morphia.*—Mrs. P. L——, aged fifty, had much trouble four or five years ago, when her husband died. She then fell off her appetite, became low spirited, and began to take too freely to the use of wines and spirits. This sad habit had increased on her the last two or three years so that she has usually been in a kind of continuous fuddle or of cerebral excitability.

In the early part of 1863, a slight injury caused excitement to break out. After being for some days in a rambling, shaking state, and either wandering or sleepless at night, she suddenly became violently excited, *refusing to swallow* medicine or anything else. She had no sleep for forty-eight hours, and took to walking about the room, talking incessantly, and trying to go down-stairs into the street. *Morphia given by the mouth* for the two or three days previous to her refusal to swallow had no effect upon her, unless, indeed, it was that of increasing the cerebral excitement (as the family thought), as well as to make her sick. It failed, at all events, either to give her sleep or to quiet her. I determined, therefore, to give her a dose injected beneath the skin; as it appeared to be the only alternative, with a third night of incessant anxiety and watchfulness for the relatives to keep her within bounds. I inserted half a grain of morphia, with the syringe into the cellular tissue of the back part of the upper arm—the patient being gently, but firmly held for the moment. For a few minutes she was as violent as before, she then ceased to walk about, and very shortly slept. She slept for *ten* hours, awoke, had food, which she *before refused*, and slept again—this time for eight hours, being awake once or twice, at my request, to take food.

This patient made a most rapid recovery from that time; she has required no morphia or other anodyne from that day to this. That single injection, not only succeeded in giving sleep, but it did so without producing any of the ill effects that the stomachic narcotics had produced. It subdued all the violence in a few minutes, and compelled sleep in her at the time determined not to sleep.

She then took food readily, and even eagerly, and plenty of port wine. She slept well the next night. I gradually each day diminished the wine, which I substituted for the brandy of old. The most important point now to be noticed is that the *habit of drinking* has been completely broken. This patient now takes her one or two glasses of wine a day, but never more; she is a changed woman, and is "herself again," as she was before the days of her misfortune.

This case is given as one among many instances of the remarkable effects of an hypodermic dose. It shows how very differently the *same dose* of the same agent acts by the skin and the stomach. How delirium and absence of sleep continued with the stomachic *doses*, but were both at once checked by the single hypodermic dose. The immediate return of the patient's control over her dipsomaniacal appetite, after her sleep of eighteen hours, with the slight interruption to take food, is not the least important feature of *the case*.



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