

AN  
INAUGURAL DISSERTATION  
ON

*Tetanus*

SUBMITTED TO THE  
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BY  
*Hamilton Black*

OF  
*Tennessee*

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Dedication.

To  
Austin Miller Esq.

as

a mark of respect  
and

In grateful acknowledgments of  
many acts of kindness

This dissertation is  
Affectionately inscribed  
By his friend, the

Author.

Good

Examined by J.F.G.

## Tetanus

Tetanus, is a nervous disease and is characterized by long and continued muscular contraction either in various parts or almost the whole of the body, and in regard to spasmodic diseases it is considered as one of the most fearful and fatal maladies to which the human subject is liable.

The contractions of the muscles are accompanied with very severe and excruciating pain and with brief paroxysms alternating with irregular intervals of more or less complete relaxations. The mental faculties are scarcely ever disturbed or if so it is not pathognomonic.

Different names have been given to the different tetanic conditions or to the different effects produced by the spasms, for



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instance when a curvature of the spine backwards is produced it is denominated Opisthotonos, when forwards Emprosthotonos, when to one side Pleurosthotonos, and when the closure of the jaws is the effect it is Trismus or locked jaw.

And again it has been by some divided into Symptomatic and idiopathic, the latter existing without any known cause while the former is produced by some other affection for instance a cut on any of the limbs or any part, may produce it and when brought about in this way it is denominated Traumatic Tetanus.

In relation to the disease from other sources but little is known or at least there is great uncertainty and doubt, some ascribing it to one cause & some to another but generally all acknowledge its obscurity.

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In order to have some designation most-writers at the present day include under the head of idiopathic tetanus all causes that are not traumatic, it mattering not whether they exist independent or symptomatic of some other affection.

Tetanus has still other divisions into the acute and chronic or subacute. But it seems that although the disease may differ in intensity and duration yet it has been considered by some that there is no such singularity of character connected with its diversity of grade, and duration as to require this separate grouping, and that the terms if employed at all should only be used to express the difference of quality belonging to the same affection.

Etymology. It seems as if a



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Predisposition is requisite to produce this disease generally, as but few are attacked who have been exposed to the supposed exciting cause, for instance a man may be exposed to all the vicissitudes of climate to extreme cold and heat or he may receive a cut of a very severe nature upon any part of his person and never suffer from an attack of Tetanus, while on the other hand another person may be equally exposed or receive a very slight wound even a rupture of the epidermis and suffer severely from Tetanus and perhaps lose his life, but where and in what this predisposition consists is utterly unknown.

Idiopathic Tetanus, is by no means common in this country but is far more frequent in the Tropics than in cold or

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Temperate climates, from this fact it is highly probable that a long continued prevalence of heat is very favourable to its production.

Residing in low and damp situations bad diet & clothing vitiated air is thought to constitute a predisposition, but how true this is is unknown for we may see the traumatic form of the disease existing in the young strong and robust persons.

The exciting causes such as wounds or other kinds of external violence are by far the most frequent in this or any temperate or cold climate, as regards the extent of a wound requisite to produce tetanus but little importance can be attached for as has been remarked even the slightest scratch may be sufficient to bring it on while a severe wound may fail entirely



to produce it, The kind of a wound from which it most frequently results are those made by Needles in the fingers, Splinters Thrust beneath the nails, Those made by the whip, or switch as pieces of the instrument is sometimes left in the wound, running Nails in the feet The cutting off of Corns &c, Tetanus is more apt to result from wounds in the fingers Soles of the feet and joints than from wounds made on any other part of the person.

Concerning the stage or state of a wound at which tetanus is most likely to occur, a good deal has been said by different authors but it is thought that it may, or is equally liable to occur in any condition of a wound, whether it is after or before supuration whether it be healthy or unhealthy, or whether it be before or after the



healing stage has come on or even after the healing has been completed.

The interval between the reception of a wound and the occurrence of tetanus is commonly about five days, though this is a disputed point some alleging that it occurs in a few minutes and some in three or four days or weeks after the reception of the wound, but if the patient escape during the period of three weeks he is generally considered safe from an attack of this exceedingly fatal malady.

The idiopathic form of this disease is perhaps produced by long exposure to heat and cold rainy or damp weather, resorting to the cold bath as a means to cool the system when it has been greatly heated by active exercise. Cold drinks &c may be considered among

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its leading causes.

Tetanus is said to be produced generally from inflammation of the Spinal Cord, yet have not there been numberless instances in which inflammation of the highest grade existed in the Spinal Cord and yet it was not attended or followed by tetanus.

And again we may see it existing in persons independent of any inflammation. It is also said that we may content ourselves by referring it to irritation of the Spinal Cord either of a direct or indirect nature and that, that irritation is produced by mechanical means, such as the spicula of bone being in contact with the cord or its membranes, yet it seems scarcely possible that all cases resulting from mechanical irritation and that, that mechanical means being in immediate contact with



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The Spinal Cord could be cured independent of an operation or by medical treatment alone. Yet we read of perfect cures of tetanus when its cause was attributed to this mechanical irritation and that this cure was effected by some specific remedy, so we not see that when irritation is set up (if it be at all) by injuries remote from the Spinal Cord an operation is often required before the disease will abate?

And it seems that when irritation is brought about by indirect means, or by injuries remote from the Spinal Cord that, that injury would have to be inflicted upon a sensorial fibre, in order that a sense of the injury might be conveyed by that fibre to the Cranio-spinal axis and that then an answering influence would have to be brought back by the motor nerve before the diseased action could be set up.

But this answering influence is not always returned to that part of the person on which the seat of the Cause is located, but may be carried to another part of the body entirely, so that we have the Cause in one part of the person while the effect is in another but how to account for this wide separation of Cause and effect is utterly impossible.

Symptoms: The prominent and leading symptoms are general uneasiness, stiffness of some of the muscles of the neck, especially those on the posterior part, there is also some stiffness or rigidity about the jaw, attended with pain when an attempt to swallow is made, and the mouth cannot be opened rapidly without producing an unpleasant sensation or some pain. Sharp lancinating pains are felt not unrequently in the epigastrium,



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Commencing at the Pit of the Stomach and proceeding toward the Spine, accompanied by a dragging sensation which is said undoubtedly to be spasms of the diaphragm, and from this the disease manifests its self more or less throughout the whole system involving the muscles of Voluntary Motion.

The muscles are seldom in a state of Complete relaxation, but are hard and rigid this to some extent exists throughout the Complaint, being slight at first but as the disease advances and becomes fully formed it gives to the muscles a sense of hardness almost equal to that of a board. Paroxysms of Spasms also occur of an irregular Convulsive nature alternating with periods of comparative relaxation. These paroxysms are at first slight and at distant intervals, but as the disease advances they increase with rapidity in frequency & violence.

until at length they come on so often that there is but a very short period of time intervening between their occurrence, not more than five or ten minutes, and with such violence do they make their attacks as to toss the body about in different attitudes so much so as in many instances to endanger injury therefrom.

These spasms are attended with extreme pain and the slightest cause will often be sufficient to bring them on, such as a sudden breeze blowing upon the patient, a sudden noise, an attempt to speak, and their force is such as often to occasion rupture of the muscles or some of their fibres and to fracture some of the bones. The teeth have been known to be broken by the violent closure of the jaws, and the tongue being interposed between them at the



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time of spasm has been severely and violently bitten. The disease is said to manifest itself in four cases out of five by the sudden closure of the jaws, or trismus, this mode of attack being the foundation of the vulgar name, "Lock Jaw" and by this the disease is generally designated. But sometimes in traumatic tetanus the symptoms of this disease may be, and often is observed first in the wounded limb by a slight twitching of the muscles or an occasionally spasmodic jerk.

In ~~some~~<sup>more</sup> cases the muscles of the back are most commonly affected, and the muscles of the anterior part of the body may be simultaneously affected but owing to their comparative weakness with those of the back, are not able to counteract them and consequently owing to the superior contraction, and strength of the muscles of the back to those of the

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abdomen the patients body is thrown into the form of a bow or arch, so that he rests entirely upon his head and heels, occasionally though very rare the abdominal muscles act with <sup>enough</sup> force as to roll the patient up like a hoop the head and feet being placed together, and still more rarely tetanus lateralis or pleurosthotonos. The body being drawn to one side but these latter effects of the disease are very rare, those of trismus and opisthotonos being the more frequent effects of Tetanus

The general aspect of the patient is often frightful during a fit of exacerbation, the eyes <sup>are</sup> motionless the orbicularis muscles of the eye are rigid and contracted, the forehead is corrugated and the nostrils spread, the corners of the mouth are drawn back the teeth exposed, and set and in short all the features are fixed in a ghastly and demonic grin, but



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notwithstanding all this disturbance of the muscular system there appears commonly none, or but very little derangement of ~~other~~ functions.

Tetanus is generally attended with obstinate constipation, and when stools are obtained they are very unnatural and have an offensive smell, ~~owing~~ respiration becomes quiet and very difficult owing perhaps to rigidity of the diaphragm and other muscles concerned in the respiratory process, and dyspnea of the most painful kind is often experienced in consequence of the imperfect expansion of the chest.

In regard to fever in tetanus it is thought that strictly speaking there is none, the pulse is quickened considerably but it is attributed to the violent contraction of the muscles, and as a natural consequence a more rapid expenditure of blood is called for the heart being stimulated to more frequent action. Perspiration is often very profuse owing probably to the

Violent muscular action and suffering,  
The urine is scanty and high coloured.  
The mental functions are seldom if  
ever at all affected in tetanus, so that  
we can scarcely observe any delirium or  
coma, and if these symptoms do occur  
it is generally when the failure of other  
powers of life begin to manifest themselves.  
The patient seldom enjoys much sleep  
owing to the violence of the paroxysms and  
their frequency, he may fall asleep  
during the cessation of the paroxysm  
but does not remain so long as the  
slightest cause serves to awaken him  
and as has been remarked bring on  
paroxysms. Tetanus in its course is  
very variable in different persons, in  
some it is of a remittent type while  
in others it is of a continued form  
progressing regularly on in its course,  
until death. In regard to the duration  
of the disease it may be set down  
as uncertain some dying within a  
day after the attack and indeed it



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is recorded that cases have been known to expire in ten or fifteen minutes after the attack, if this be true then how is it possible for the theory of placing the seat of this disease in the spinal cord be true? or that inflammation of the cord or its membranes is a necessary requisite in order to bring on the disease? for could inflammation of that degree which is requisite to produce death be established, in this short period whether from a cause in immediate contact or remote from the spinal cord? deaths which result ~~from~~ in the above short time might have been in all probability owing to convulsions rather than to tetanus, others again die in three or four days but as a general thing they expire about the fifth day after the attack, and if they survive the eighth we may entertain great hopes of their recovery. Death in tetanus may take place from a variety of causes, the vital powers may from very long

and continued nervous excitement at length fail and thus death may be brought about, or it may result from severe spasm of the glottis in which respiration is entirely suspended, and many cases are said to have died solely from the want of nutrition. But since it has been asserted by authors of high repute that the true and proper seat of tetanus is in the Spinal marrow, may it not be asked that in a majority of instances if the patient does not die of excessive irritation or inflammation of the Spinal marrow or its investing membranes? but this question may be answered from the fact that in a great number of persons dying with tetanus post-mortem examinations have failed to reveal any great signs of inflammation in these parts, hence may we not doubt this as being the seat of the disease, for surely a disease producing such awful and intolerable



suffering as Tetanus, would leave in its seat or location in legible characters some sign of its ravages.

Diagnosis: Tetanus in its characteristic symptoms is so striking that we are not very likely to confound it with any other disease, if we observe closely and correctly, but by inattention and superficial observation we may possibly mistake it for some other nervous disease, for instance hydrophobia or hysteria, but there are symptoms in tetanus so marked and so striking in their nature as to render it perfectly easy to distinguish it from either of the above named diseases.

Hydrophobia resembles tetanus in the aggravation of its paroxysms by the slightest cause, for instance a slight breeze or opening the door of the apartment, a whisper &c will serve to aggravate the symptoms of both diseases. They are also alike in the difficulty of deglutition, but tetanus may be distinguished from hydro-

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phobia by the continuance of the spasms,  
and by the patient being sensible and calm  
until death. While on the other hand in hy-  
drophobia there is convulsions with perfect  
intermissions and the patient as a general  
thing is delirious and has a continued glai-  
ving and haggard expression about the  
countenance, and besides this hydrophobia  
has never been known to originate spon-  
taneously in man, but must be conveyed  
to him by some of the rabid animals, and  
if we see a patient with a wound upon  
his person we may decide as to the disease  
by ascertaining how and by what means  
that wound was inflicted, if it was  
made by any rabid animal we may pretty  
correctly conclude that it is hydrophobia.

We may distinguish it from  
hysteria by the above characteristic symp-  
toms of tetanus, and as a general thing  
hysteria is confined to the females, so  
that we are not likely to confound it  
with tetanus in the male, though well  
marked cases of hysteria have been known



to exist in the male. In the female we may distinguish it from hysteria by the absence of that symptom which they describe as a ball rolling through the abdomen, and which is almost a never failing symptom in hysteria. Laughing and weeping are also almost never failing symptoms in hysteria, which we never observe in tetanus. The above diseases (Hydrophobia & hysteria) are the most likely to be mistaken for tetanus. The poisonous effects of certain medicines are said to resemble it very much, for instance that that of Nux-Vomica which is said really to be a form of tetanus, but of these we must form our diagnosis according to the circumstances and history of the case.

*Prognosis.* Tetanus is an exceedingly fatal disease especially that form of it denominated traumatic tetanus, so much so that according to statistics not more than one out of five recover from it. Tetanus of both forms is more fatal in hot, than in cold or temperate climates.

The idiopathic form occurring in either of the latter named climates is generally considered curable. In order to make out a favourable prognosis the symptoms must be of a very mild nature. In the onset if respiration is not greatly interfered with, and the circulation proceed naturally and regularly, and if there is complete relaxation of the muscular system between the paroxysms, and if sleep can be procured by the appropriate remedy, and the protraction of the disease beyond the seventh or eighth day we may set down the prognosis as favourable. But if the symptoms are very severe in their nature in the commencement, if respiration is very difficult, the circulation unnatural, severe contraction of the muscles of the glottis, and the absence of sleep and the non effect of powerful remedies in attempting to produce it, we may make out an unfavourable prognosis

Treatment. In coming to consider the treatment of tetanus, nothing regular



or definite, can be offered, for so great is the catalogue of remedies that have been employed in the treatment of tetanus, all of which have been reported as having produced certain cures, that it is difficult to come to any satisfactory conclusion in regard to the proper treatment or course of treatment to pursue, for, we see that for very opposite courses success has been claimed, so what mode of treatment can we rely on with any certainty? (if there be any certainty in any) in regard to the safety of the patient. It appears from this diversity of opinion in regard to the treatment of this disease that the physician would be justifiable in employing any remedy which according to his best judgment would be most appropriate in combating the presenting symptoms.

Admitting tetanus to consist principally in irritation, and not in inflammation, of the spinal cord, the indications after viewing the disease in this light to be fulfilled are, first to remove all causes of irritation,

In order to do this if the disease be traumatic, we must in the first place give our attention to the wound, we should examine it closely and if there be any foreign body in it we must remove it and bind it up with adhesive strips, but before doing this we may examine it for the purpose of seeing whether or not it be healthy or unhealthy, or whether inflammation or suppuration has come on, if it be <sup>in a</sup> healthy condition or if the stages of inflammation or suppuration have come on, we may attempt to heal it by the first intention by cleansing it and applying the adhesive strips, and the roller bandage if it be called for. But if the above stages of inflammation and suppuration have been set up our treatment must be different, we must apply for the purpose of combatting or allaying inflammation, poultices and anodyne applications, for instance a poultice containing some narcotic preparation such as the Sulphate of Morphia; Cold applications if there be much heat and fever in the part may be applied with advantage. But suppose the



wound to be a lacerated or punctured one, and that the nerve has been partly divided, what must be done? The books tell us or recommend that a very nice incision should be made above the injury so as to completely divide the nerve injured, or the main trunk which is still better as they say for the purpose of cutting off its communication with the spinal cord. But why do this? May we or do we not do as much injury to the nerve by thus wholly dividing as if we had left it only partly so, really it seems very much so when we know that tetanus often results from very nice and skillful operations in which the nervous trunks are involved.

But if we should resolve on giving this operation a trial it should be done in the early stages of the disease before any morbid condition of the nervous system has had time to establish itself. Amputation has also been recommended in traumatic cases, but the supposed cures resulting from either of these operations are few, and it is impossible

to ascertain how far these operations are of service for the disease might have gotten well spontaneously in those few cases in which the operation was the supposed cure.

Since we see that the slightest movement or impregion made upon the surface or senses of the patient is sufficient to bring on the nervous spasms, it is of great importance in our treatment, to protect the patient against them.

In order to do this we should place the patient in a darkned room and exclude all noise therefrom, visitors and friends should not be allowed to enter or disturb him in any way, he should not if it be possible be permitted to move a single muscle or to speak or swallow unless it be absolutely necessary, having done this we may now direct our attention to the condition of the bowels and if there be any degree of constipation we must remove it by some brisk purgative and then keep



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The bowels open Throughout the disease,  
But if we are not called in during the  
first stages, perhaps it would be better  
to give some mild purgative so that we  
may not disturb greatly the general sys-  
tem or produce any irritation of the bowels.  
In the beginning of tetanus, Calomel  
combined with Jalap or the compound  
extract of Colocynth, the compound Cathar-  
tic pills Senna and Sulphate of magnesia  
may be employed and after their  
action to give something milder to  
keep open the bowels, but when we have  
not been called in until the latter stages  
or until the disease has been in progress  
several days, when we wish the effect  
of the remedy to be mild blue mass or  
Calomel & Castor oil are suitable, and should  
we entertain any suspicion of the ex-  
istence of worms in the alimentary canal  
they should be removed immediately by  
some active anthelmintic, a combination  
of Calomel, Castor oil & wormseed oil may  
answer, or the oil of Turpentine and

Castor oil in proportion of half an ounce of the former, to an ounce of the latter may answer still better the purpose.

Bloodletting, in tetanus is wholly uncalled for except it be when the disease has followed some severe and extensive injury, where inflammation has been set up and fever of the general system induced, but even here we should be very cautious in resorting to it, or the quantity we take in view of the great prostration of strength that supervens in the latter stages of the disease, if we resort to it; it should be done in the early stages and its repetition scrupulously avoided.

Next, having removed all causes of irritation as far as possible, we must now attempt to diminish in frequency, and if possible remove entirely those paroxysms of spasms in which the patient is liable, and often does expire, to do this we must diminish the susceptibility of the nervous system to those spasms. And to meet this indication narcotic remedies



must be resorted to, and the one which is said to have the most effect, and which is most frequently employed is opium or some of its preparations, but this drug has been greatly opposed as a remedy by a good many members of the profession, owing principally to its failure, but notwithstanding this a majority seem to be in favour of its use, nor should it be abandoned because of its failure in some instances, for all remedies may fail occasionally. Opium has been very much abused in its use in tetanus for as much as ~~an~~ an ounce has been given per day for several days, so that if the patient recovered from tetanus he would die from the poisonous effects of the opium. Better let the disease kill than to have the responsibility of a fellow creatures death upon us, and if we cannot employ it in less than poisonous doses why give it at all? The liquid form of opium should always be used as it is most readily absorbed, as a dose in tetanus from fifty to sixty drops may be given and from  $\frac{1}{2}$  to 1 $\frac{1}{2}$  of the vinegar may be given. Or if we

Choose to use some of the salts of Morphia  
 the Sulphate may be given in from  $\frac{1}{2}$  to 1 grain  
 in solution every two or three hours or as the  
 urgency of the case may demand and if the  
 desired effect is not produced in a short  
 time we may enlarge the dose a little or  
 inject into the rectum from 1 to 2 grains or apply  
 it to a blistered surface which may be obta-  
 ined by a very strong solution of ammonia,  
 Yarter Emetic, which has had but little trial  
 so far as I can learn, might be used with  
 advantage; it has been recommended to be  
 combined with Morphia when there is any  
 fulness of the pulse, but it seems from its  
 power of relaxing the system that it might  
 be very useful if freely and fully employed,  
 When opium fails recourse has been had  
 to Indian hemp, <sup>and</sup> as it is a very powerful  
 remedy, and requires to be used with caution.  
 From one to two grains may be given and rep-  
 eated every half hour or hour until its effects  
 are produced, and if we should fail to  
 produce any narcotic effect from the use of  
 opium and hemp it will be probably useless.



to employ others, but we may give others a trial. Alcohol has been given to meet the same indication as hemp and has had many advocates. There is no definite quantity recommended, but may be given in sufficient quantity to produce its cerebral influence, the purpose for which it is given, so as to blunt the sensibility of the brain and spinal marrow.

Other narcotics have been recommended and employed in this disease, such as Stramonium and beladonna, but opium and hemp are preferred. There is another remedy which might be of great use in fulfilling the last mentioned indication and of which very little is said in the books, I mean Chloroform. It might be given in substance but inhaling it is probably a preferable mode, from its power of lessning the sensibilities of the nervous system it seems as if it might be an excellent remedy.

Having lessened by the above remedies the susceptibility of the nervous system to the paroxysms of spasms, or having abolished them entirely, we may next endeavour to diminish

or remove entirely the existing irritation of the nerves, and relieve the rigidity of the muscular system which often exists to a considerable extent during convalescence. To do this ~~we~~ must employ sedatives, the best and most efficient and one most frequently employed is tobacco, but great caution must be observed in its use, to bring about its effects we may make an infusion of half a ~~drachm~~ of tobacco to half pint of water and the whole given at once by enema, it may be repeated in the course of one or two hours if no effect be observed from the first that was given, and so continued until its effects are obtained. Another sedative remedy which has some character in fulfilling this indication is the external application of cold water, the patient may be placed naked upon a blanket and water about the temperature of 40 or 45 degrees poured from a vessel upon him, or he may be introduced into a bath. After its use the patient is to be wiped dry and put to bed and stimulated with



brandy or the Carb: Ammonia. If the use of the bath be of advantage in removing the sufferings of the patient it may be repeated when the spasms begin to return, also the warm bath, <sup>has been tried</sup> but with little advantage not at least with as much as the cold. Blisters may be applied along the course of the spine in many cases, the best is a solution of Caustic Potash, three or four drachmas to four ounces of water and apply it with a sponge until its effects are observed upon the skin by its caustic action, it may be rapidly reapplied as soon as the inflammation resulting from the use of its former application subsides.

We must also in the course of our treatment observe closely the strength of our patient and if his system begin to fail we must support it by tonics and nutritious food. For this purpose we may give brandy or wine as tonics and animal broths, milk yolk of eggs &c as food. This treatment should be resorted to no matter what may be the stage

of the disease, if we observe the strength of the system to fail, Sulphate of Quinia owing to its peculiar effects as well as to its Tonic, may be given to meet this indication, it may be given in the dose of 2 scruples in twenty-four hours, and beside this the sub-carbonate of iron may be given as a tonic, it has been employed in very large doses as much as a pound per day has been taken, so much so that part of it has remained perfectly inert in the system, as a dose an eighth of an ounce may be given every two or three hours. or if this be not sufficient it may be increased. The oil of turpentine is said to be an excellent remedy and may be given in doses of a fluid drachm every two hours until its effects are observed, Numerous other remedies have been recommended and tried in tetanus, but those that have been mentioned seems to have been employed in the greatest number of cases and seems to be mostly indicated.

Summary. The remedies here mentioned



are a summary of those which have been spoken of as being indicated in tetanus, <sup>part</sup> to remove all sources of irritation active purging in the outset of the disease, but mild in the latter stages so as not to make the patient liable by his frequent desire for stool to be thrown into a paroxysm, Bleeding when there is danger of inflammation the use of opiates, hemp, tobacco, Chloroform, tartar emetic, the cold & warm bath, sulphate of quina and subcarbonate of iron with nutritious food in the failure of the strength of the system, blistering along the course of the spine which may consist of a solution of Caustic Potash. A difficulty is often experienced in administering medicine and food owing to the closure of the jaws, but this may be obviated by introducing a tube through the nostrils or through the opening behind the teeth or we may sustain the strength of the patient by nutritious enema.