Passed November 1880

"Tetanus," more especially with respect to treatment by Hydrate of Chloral

By
John Carlyle M.B.: C.M.: Glas.

ProQuest LLC.
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106 – 1346

The collection of symptoms which go to form the malady we know as Tetanus are so unique that it is not wonderful that this disease has attracted attention from the earliest time.
Hippocrates evidently alludes to it in the appendix to his treatise on "Regimen in Acute Diseases." He distinguishes Opisthotonos from emprosthotonos and describes a treatment slightly differing in each case. His treatment mainly consisted of venesection with sudorifics and frictions.
In his aphorisms too he remarks "Such persons as are seized with tetanus die within four days, or if they pass this they recover." Such a prognosis certainly fails to apply in the case of the disease as seen in this climate, but as Dr. Adams (Sydenhams Society Translation - Hippocrates 1849.) remarks, is nearer the

the truth when applied to cases occurring in hotter climates.

The earliest monograph on the subject to which I have been able to obtain access is that of Bilger "De Tetano" 1708. He gives an excellent clinical description of the disease, and his definition of tetanus can hardly be improved on. So much is it to the point that I here transcribe it in full. He defines tetanus as - "Convulsio tonica universalis ex emprosthotono et opisthotono composita in qua totum corpus praecipue collum obrigefecit ita ut in neutrum latus deflecti queat idque vel acta continuata vel remittent cum summo dolore vigiliis, respiratione quandoque turbata et non raro mentis abalienatione conjuncta a musculorum utriusque lateris aequali perpetua preternaturale et involuntaria versus principia contractione oriunda".

One of my cases to be hereinafter described shows an excellent example of

of the occasional brain complications above alluded to.

It could serve no useful purpose to here mention the views held by Bilger and other writers of the past as to the pathology of Tetanus, which can have but an historical interest for the students of the present day.

A bibliographical appendex is however subjoined which comprises the older as well as more modern treatises on the subject.

Passing thus briefly by the views held in past-times, we come to the opinions held at the present day. Here we find that critically considered our notions are but little more defined than those of our ancestors. Though we have emerged from the stage of hiding our ignorance of the essential nature of the phenomena in question under mere pretentious, phrases, e.g. "a determination of peccant humours inwards". We are yet forced to confess it on most points concerning their

the etiology and pathology of the malady.

Is there such a thing as "Idiopathic" tetanus? or must there always be some trauma however slight? For the production of tetanus is it essential that the injury must involve the nerves of the part? If so. how is the irritation conducted thence to the nervous centres? Or, is tetanus as Billroth surmises a blood disease dependent on a specific blood poison in favour of which surmise however he is unable to advance any tangible evidence. Again, the irritation having once reached the nervous centres, is its continuance dependent on the continuance of the peripheral irritation, or supply of poison? or having once reached them is it capable of continuance without further peripheral stimulus?

It will probably be long ere all or any of these questions are answered, nor. I fear is it in my power to throw light on questions which have divided minds so much more able and experienced than

than mine.

We will now proceed to describe the course of an ordinary case of tetanus, touching briefly on any disputed point accordingly as the facts under consideration appear to bear in favour of one or the other side of the question.

Traumatic tetanus usually supervenes on the third or fourth day after an injury seldom earlier, often later.

The injuries from which it has arisen are of most varying kinds. Incised, lacerated and contused wounds; abrasions of almost every part of the body; burns, insect bites and stings, and parturition, have all been followed by tetanus.

It however most commonly complicates injuries of parts remarkable for their copious nerve supply, as the palms of the hands, the soles of the feet, fingers, toes, face &c.

After surgical operations it is comparatively rare, the only notable exception being that of ligature of the external iliac artery after

which it has occurred in about four per cent of the cases operated on.

Implication of the genito-crural nerve in the ligature, or injury to it during the operation is probably the exciting cause of this.

Sometimes the wound has inflamed, or taken on an unhealthy appearance, but not unfrequently it is unchanged in appearance, and its healing proceeds uninterruptedly during the continuance of the tetanic complication.

The implication of the larger nerve trunks in the wound does not appear to be in any way essential to the production of the disease; but on the other hand it is clearly impossible to make any breach of continuity, however small without involving many of the fine terminal nerve filaments.

Cases, indeed, are not wanting in which tetanus has followed on wounds in which the larger nerves have been pressed on by splinters and foreign bodies, e.g. a slug

lodged

lodged close to, and pressing upon the median nerve, but as a rule no such obvious cause of nerve irritation can be discovered. Indeed the view has been advanced that tetanus is more apt to occur after trivial than severe injuries This however is probably an error arising from the much more frequent occurrence of slight than of severe injuries.
Be this as it may there is abundance of evidence to show that tetanus may supervene on the most trivial injuries. In connection with this point arises the question, is there such an occurrence as "Idiopathic" tetanus.
It is hard to find any person who can show a skin entirely free from breach of surface. Nearly always small abrasions and scratches are to be found on the skin of those of us even that are best protected from injury. And in the tropics from which we obtain our largest contributions of "idiopathic" cases, insect bites are so common and give rise to so much scratching

scratching, that a perfectly whole skin must be of the rarest occurrence.
A case in point is recorded by D.J. Hamet in the "Lancet" April 20th 1878. Where a candidate in a clinical examination was apportioned a case of "idiopathic" tetanus. The examiner pressed the candidate hard as to whether the case was traumatic, or idiopathic, and the latter turned back to the patient and after some searching, to the astonishment of all discovered a thorn imbedded in the palm of the hand which had hitherto been quite overlooked both by doctor and patient. On these accounts I can not but think that we should accept all idiopathic cases with the utmost reservation. As has been already remarked the appearance and healing of the wound is often quite unaltered, and in cases that live long enough cicatrization has often been completed sometime before the fatal termination of the case.

This

This circumstance evidently bears strongly in favour of the view that tetanus once set up is capable of continuance quite independently of stimulus from its original starting point. And this comes to be a most practical consideration in connection with the justifiableness of such measures as amputations, excision of cicatrice, neurotomy or nerve stretching, all of which have been tried, and in spite of occasional successes, found wanting.

Let us now turn back to our imaginary case. Our patient will probably in the first instance complain merely of some stiffness of the neck and will easily find some exposure to a draught to account for the "stiff neck", he has caught. This however gets steadily worse instead of better and by the next day will have spread to the muscles of the face, producing the peculiar fixed sad smile, the well known "Risus Sardonicus". The muscles

&c

of the jaws now participate and soon the teeth are firmly clenched, and even during the intermissions of the spasms can only be at best slightly separated.

Now tetanic spasms of the trunk and extremities, sometimes more of the one, sometimes more of the other supervene These may affect mainly the muscles of the back (Opisthotonos), or of the anterior aspect of the body (emprosthotonos), or of either side (pleurosthotonos).

They cause intense agony, the patient being bent either back like a bow, or resting merely on his heels and occiput, or doubling him completely up, according to the set of muscles mainly affected. In the intervals between the paroxysms the muscles are still rigidly contracted but not in the violent manner that occurs during the exacerbations.

After the body is bathed in perspiration and the urine albuminous.

The

The mind is usually clear at first and often remains unaffected throughout, but later on it is no rare thing for delirium, sometimes of a violent character to occur.

The temperature varies greatly, causes him, on the one hand, to a rapidly fatal termination without any rise of temperature, while on the other, it may be the first indication of impending mischief. May amount to extreme hyperpyrexia and may continue to rise even after death.

Such being the symptoms, the acuteness of the case may be considered as proportional directly to the frequency and violence of the spasms.

In the more acute forms of the disease death usually takes place early, within, say, three to five days. In the more subacute forms the course is longer, and the prognosis becomes steadily better for each day that is gained.

If the patient survives ten to fourteen days the outlook becomes quite hopeful, though

though many cases die after surviving for a much longer period. Acute cases are nearly always fatal. it is excessively rare for them to terminate by emerging into the chronic form.

Tetanic manifestations can be artificially produced in animals either by poisoning by strychnine, or by passing strong electric currents through the entire spinal cord. In either case there is usually a considerable increase of blood temperature produced as- A. Rick (Billroths Surgery) has shown in the muscular system. Hence the rise of temperature in the rectum after death is merely "a phenomenon of the egnalisation of heat between the muscles and the rest of the body."

We now come to the pathological Appearances found in fatal cases.

Locally, the wound usually presents nothing abnormal, nor, are any constant lesions to be found in the nerves leading from the part to the nervous centres.

Extravasations of blood into their substance and

and reddening from extravasations in their neighbourhood often mistaken for inflammation have been again and again described.

These however are not constant and are quite accidental being merely due to the violent contractions of the surrounding muscles. These latter often show partial, or complete rupture in various parts of the body. The recti abdominales, and erectores spinae being those most frequently thus affected.

Turning now to the central nervous system we find that the accounts of different investigators vary greatly. A certain amount of injection of the cord and Medulla Oblongata appears to have been noticed by most, but, beyond that their results are for the most part entirely negative.

This injection however is not constant and merely due to the death being so frequently to a great extent from asphyxia.

Occasionally however changes of a coarse and more obvious description have been found. e.g. Barrington and Wright in Guy's

Guys Hospital Reports 1879. p 185. describe a case in which cavities were found in the grey portion of the cord both in the cervical and lumbar regions. The changes were confined to the right half of the cord in the cervical, and to the left half in the lumbar region. and extended as fissures for some distance along the cord which showed but little alteration of structure, even in their immediate vicinity.

On comparing the locality of these lesions with those discovered by Dr Ross, and described further on, it will be seen that both occupy the same region of the grey matter, a circumstance which makes it probable that Carrington's case is but an advanced stage of the appearances described by Dr Ross.

Such an extreme degree of disintegration is however extremely rare, and the but little obvious changes described by the latter named gentleman are those probably most commonly to be found. Their slightness having probably caused them to be overlooked

overlooked is no. doubt the reason of the many negative results of previous investigations.

Billroth states that he has been able to obtain only negative results, and is thus led to look sceptically on the investigations of Rokitansky, Dr. Gull of Zurich, and Meynert of Vienna, who all describe appearances which they believe to be due to inflammatory new growth.

Drs. Lockhart-Clarke, Clifford Allbutt and Dickenson, describe certain granular degenerations of the nerve cells. They however differ among themselves in minute details, a circumstance which leads Drs. Wilks and Moxon while alluding to these investigations to suggest that the changes in question were post mortem, or at any rate, "widely open to suspicion".

The most recent contribution to our knowledge of the subject is that of Dr. James Ross, (Patholog. Soc. Trans. vol. XXX. p215) and are strongly confirmatory of the older observations of Lockhart Clarke, Dickenson, Allbutt and others while

while they are at the same time considerably more definite.

The changes he describes are mainly -

(1) An injection of the blood vessels.

(2) An infiltration of leucocytes into the tissue of the cord in their immediate vicinity.

(3) A remarkable change in the ganglion cells of the anterior horn of the cord, especially in certain definite groups. This latter change consists in the corpuscles becoming shrunken and losing their power of strongly staining with carmine.

On this account sections examined under a low power appear to have, in places altogether lost their corpuscles, and it is only on examining with a higher power that their shrunken and ill stained remains can be discovered.

This change affects principally the cells of the median groups of anterior horn as well as some of those in front of the antero-lateral, and some between the antero and

and postero-lateral groups, as well as part of the posterior portion of the postero-lateral group.

In the medulla the parts most affected were the nuclei of the hypoglossal, pneumogastric and spinal accessory.

Changes of a similar but more intense description were found in the cord and medulla in cases of death from hydrophobia with which clinically as well as pathologically tetanus has the nearest relationship.

As has already been remarked the prognosis in tetanus is very bad, and from this it follows that treatment has been hitherto very unsatisfactory. Operative measures of various kinds have been repeatedly tried, but against these, for reasons already detailed, I have a strong predisposition Severe sweating has scored one or two successes, but can hardly be applicable to cases where hyperpyrexia is a marked symptom, as in itself this often amounts to a distinct danger, and would seem to

to require to be combated with the cold pack rather than a hot-vapour bath.

The Pharmacopoeia has been ransacked to find a remedy for tetanus, but when we consider the strong analogy between traumatic and strychnine tetanus, there are but three drugs from which we can claim much probable benefit from a physiological standpoint. These are.-

Calabar Bean.

Curare.

Chloral Hydrate.

Of these, Curare has been found to be a pure muscle poison, having in all probability no action whatever on the nervous Centres. Physostigmine, or Eserine (the alkaloid of Calabar bean) on the other hand acts especially on the spinal cord, and the muscular enfeeblement produced by it is due to the paralysing of the motor-power of the cord. All reflex activity ceases and after a time the conductivity of the motor nerves is secondarily lessened. It has been proved to act as a successful antidote

antidote in strychnine poisoning, and hence appears especially suited for the treatment of tetanus

Its drawback is that having no action on the brain, it can in no way combat the agonizing pain which wears out the resisting power so needful to a patient who has to struggle against so eschaustsing a malady as tetanus.

Chloral hydrate like calabar bean (though to a less extent) exerts a powerful depressing action on the Spinal Cord, markedly diminishing its reflex irritability. But in addition it is a powerful hypnotic, producing a general anaemic condition of the central nervous system. On these grounds, Chloral hydrate appears a priori, to be the most powerful weapon we possess against this remarkable and truly distressing malady.

My attention has been of late directed to this point by two cases which have occurred in my own practice, both of which recovered under the steady

administration

administration of Chloral.

The notes of the first case I read before a meeting of the "Aberdeen, Banff, and Kincardine Branch of the British Medical Association", and which appeared in the Journal. April 24th. 1880, p 626.

The details of these cases are as follows.—

(1) Alex. McFarlane, aet 43. employed in a Chemical factory. On Nov. 22-1878. sustained a severe crush of the right forefinger by machinary. necessitating amputation through the second phalangeal joint.

Nov. 24. Two days after, on removing the dressings, it was found that about a third of the flap covering the end of the bone was showing signes of sloughing. Linseed meal poultices were then regularly applied for the next two days. when the slough having separated the stump looked clean and healthy. Carbolic oil (1 in 20) dressing was now used in exchange for the poultices.

On the evening of the same day, the fourth from the accident he complained of a general uneasiness, some difficulty of breathing and

and a sharp pain in the upper part of the epigastrium which the patient attributed to having caught cold. A physical examination of the chest and abdomen revealed nothing abnormal. Suspecting his symptoms to be of a tetanic nature, I ordered him a pill containing one fourth of a grain of the ext. of belladonna every five hours.

The following morning his symptoms were more pronounced, the patient complaining in addition of pain and stiffness about the neck with difficulty in opening his jaws. The recti abdominales and pectoral muscles rigid. and convulsive fits of difficulty of breathing. Skin bathed in perspiration. Temp^t in the axilla 101 Fahr. Pulse 90. Full and strong.

The surface of the stump was exctremely tender, but looking healthy. No tender spots could be found along the course of the nerves of the affected finger, hand, or arm.

At 11-30 A.M. he was seen by Dr. John. C. Ogilvie Will. Aberdeen. in consultation, and it was decided to revert to poulticing the

stump.

stimps with the addition of tincture of Opium to the poultices, to continue the pills, and to push liquid nourishment so long as the patient was able to swallow.

Nov. 26. 3. a.m. During the last ten hours his condition changed rapidly for the worse crying out occasionally from acute pain mainly at the epigastrium and darting through to the back. Has not swallowed anything from inability to open his jaws. The so called "risus sardonicus" was well marked, and the jaws closed with the saliva dribbling from the corners of the lips. The trunk and limbs rigid and somewhat bent backwards. Skin perspiring freely. Pulse 104. tempt 103 2/5 Fahr.

Wishing to try the effects of Chloral in this case, I injected into the cavity of the mouth, through the space which exists behind the last molar teeth, 30 grains of Chloral in solution. The effect was rapid and marked. Within half an hour the jaws began to relax a little. The pains of the neck. epigastrium and back were at first greatly aggravated but

but gradually wore off. After which there seemed to be an interval of an hour and a half of entire freedom from pain
Encouraged by these results, I repeated the dose with a further amelioration of the symptoms for, although the jaws could not be separated beyond an eighth of an inch, he appeared to regain a certain amount of voluntary control over the muscles of the jaws allowing the patient to be fed with concentrated liquid food at frequent intervals.
For the next twenty four hours a draught containing 24 grains was given every four hours and the liquid nourishment during the intervals.
The stump looking healthy was now dressed with warm carbolic oil and Opium.
Nov. 27. This morning the report is still more favourable. The patient had some sleep during the night, feels easier, but drowsy. The pain at the pit of the stomach is occasionally complained of. and the muscles of the body still rigid. but those of the limbs lax

like

Pulse 104. temp[t] 103.
The draughts were ordered to be continued
now every six hours.
Dec 1. Up to this time there has been a gradual improvement, and to-day the patient can open his jaws nearly to the full extent.
Breath fetid, tongue loaded with a yellowish brown fur. but moist, bowels open
The body is entirely free from muscular rigidity and is able to sit up in bed,
Cheeks somewhat flushed, pupils dilated with injected conjunctiva. He is quite rational when spoken to but very restless when left alone. Pulse 90 & good strength, temp[t] 99.
The Chloral draughts were now discontinued.
The same evening during a temporary absence of his nurse, he got out of bed and wandered towards the window of his room through the glass of which he pushed his left arm, receiving a wound about an inch long running obliquely across the outer aspect of the forearm about half an inch above the Styloid process of the ulna. The edges of this wound were brought together with two sutures and
dressed

dressed with water dressing.
Was ordered five grains of Pil. Hydr. Subchlor. Co.
to be followed in seven hours by a Saline
Cascative.
Dec^r Patient is not so restless, and is
quite rational. No tetanic symptoms
except occasional pain at the pit of the
stomach and back. Bowels acted on
by the medicine. Feels weak. Pulse 90. Compressible. Temp^t 98 2/5.
Was ordered a tablespoonful of brandy in
some soda water every four hours.
Wound of arm looking well, no undue redness, lips close. Lectures removed, Dressed
as before.
Dec^r 4 To-day there is a return of Trismus
and general tetanic rigidity of the muscles
of the trunk and limbs which have gradually set in since the previous night, during
which time the temp^t has risen from the
normal to 101. Pulse 90.
Twenty grains of Chloral were now injected
in the manner previously described, and
to the astonishment of all at the bedside,

no

in fifteen minutes he was able to open his jaws to the extent of half an inch, and to swallow a quantity of milk and beef tea. A draught of the same strength was ordered to be repeated in six hours.

Dec. 6. Since last report there has been a steady improvement. Patient is able to sit up in bed, to masticate and swallow solid food. There has been no return of tetanic symptoms after the second dose of Chloral, but there is still some pain at the upper part of the epigastrium complained of. Pulse and Temp.t normal.

Wound of arm nearly well.

Surface of Stump still cicatrizing. granulations being exuberant were touched with Sulphate of Copper and dressed with "Red wash".

From this date he gradually improved with tonics and liberal diet.

In the second case the symptoms were not so evident. Hydrate of Chloral being administered early. Briefly, the case was as follows:-

(2) James Marshall, aet 46. Millwrighter.

Healthy

healthy, though rather anaemic looking.
came under my care, March 15. 1850. with
an abscess of the left forefinger.
On examination, the nignal phalanx was
found necrosed, the result of Whitlow.
I excised it through an incision made on
the palmar aspect of the finger, the wound
being afterwards dressed with Carbolic oil (1
in 20) in the ordinary way.
On the evening of the third day after the
operation, I was asked to see him at his
residence when he complained of stiffness
and pain about the neck, temples, and jaws
with inability to open the latter widely, a
want of freedom in the respiratory move-
ments of the chest, Spasmodic pain at
the pit of the stomach darting through to the
back, and cramping pains down the legs.
On passing the hand over the abdomen the
recti abdominales were somewhat rigid.
Skin moist, Pulse 120, Temp.e taken in the
axilla. 102 Fahr.
The affected finger presented nothing abnormal,
Opium was added to the oil, and the pulp
dressed

dressed as before.

Twenty grains of Chloral in some Syrup were given with the Syringe in the manner described in the former case. The patient being unable to swallow, the greater part of the draught was kept sometime in the mouth and no apparent benefit followed. I repeated the dose in an hour which seemed to disappear more quickly from the buccal cavity. From fifteen to twenty minutes after the second draught there was a decided general improvement, and great alleviation of pain. The patient seemed to regain more voluntary control over the muscles of the jaws and those of deglutition. There were however no perceptible difference in the degree of rigidity of the Recti muscles.

Chloral was the only drug administered in this case for the next nine days, during which the symptoms gradually improved though varying in intensity according to the amount of Chloral given and the duration of time between the doses.

On the ninth day of the treatment although complaint was made of pain at the pit of the

the Stomach and slightly over the region of the eighth dorsal vertebra, probably due to a racked state of the diaphragm. all indication of spasms were gone, and there were no traces of rigidity in the muscles of the trunk.

On the thirteenth day the patient was able to leave his bed

General conclusions cannot of course be drawn from a couple of cases. but there can be no doubt that the treatment by Chloral hydrate has been successful far beyond the usual percentage of recoveries. e.g. –

Dr. Macnamara. (Practitioner. Nov. 1872) collected twenty consecutive cases, with seventeen recoveries.

Dr. Roberts. (Americ. jour. Med. Science) nineteen cases under various treatment, three of which treated by Chloral. all recovered.

Making a total of 23 cases treated by Chloral with 20 recoveries, showing a Mortality of 13. per. Cent.

In order the better to judge for myself on this point. I have searched in the medical journals

journals of the last few years and have collected the following thirty cases taking at random without reference to result, in which chloral hydrate formed a prominent point in the treatment

Table of Cases treated by Chloral Hydrate

Author	Cause	Source	Result	Remarks
Carruthers	Injury	Ed. Med. Jour /16-/17.	R.	Combined with K.Br.
Do.	Scald.	Do.	R.	
Angus Macdonald	Parturition	Ed. Med. Jour. /14-/15 p 1110.	D.	
Gasparo Bonci	Wound of thumb	Ed. Med. Jour /13-/14 p 486	R.	-
Ferguson. A.	Do.	Ed Med Jour /12-/13	R.	Combined with K.Br.
Laydam Knox	Crush great toe	Amer. Jour. Med. Sc. June 1871	R.	
Editor	Wound of heel	New York Med. Jour. Jan 1871	D.	
Do.	Comp. fract. of tibia and fibula	Do.	R.	
Verneuil	Crush. forefinger	Gazet. des Hôpitaux No 38 - 1870	R.	Combined with Morphia
Do.	Crush finger	Do. No 43. - 1870.	R.	Do. with K.Br.
Dubreil & Cuinas	Saw wound thumb and finger	Do. No 68. 1870.	R.	Combined with K.Br. and Continuous Current.
Heath	Abrasion Scalp	Lancet March 2 1878.	R.	Combined with K.Br.
Davis & Howard	Idiopathic	Lancet Feb 16/78	D.	
Boon. A.P.	Five cases	Lancet Feb 16. 1878.	D.	Combined mostly with Cannab. Ind. Perfect
	Cause not		R.	Quiet. avoidance of light draughts and
	Stated in		R	other Stimulus.
	every case.		R.	Lays stress on the avoidance of all
	Four recoveries		R.	purgatives.
	one death			

Table of cases treated by Chloral Hydrate Cont.

Author	Cause	Source	Result	Remarks
Watson. E. P.	Idiopathic	Lancet Feb 16/78	R.	Combined with Atropia.
Samuels. W. R. G	Splinter in leg	Lancet Feb 16/78	D.	
Lawson A.	Wound of foot	Lancet Feb 16/78	R	
Skaife	Traumatic	Br. Med Jour. Nov 1878.	R.	Combined with K. Br.
Do.	Do.	Do.	R	
Miles. Geo.	Lacerated wound of Hand	Br Med Jour. Jan 19-1878	R.	
Do.	Lacerated finger	Do.	R.	
Guéniot	Impl. Breast	Br Med Jour. Oct 6 1877.	R.	
Boyd. M.	Abortion	Dub. Obstet. Soc May 1874.	D.	
Stirling. E C	Traumatic	St Georges. Hos. Rep. Vol IX. p 651	R.	Out of seven cases on all treatments, Only one recovered, and one of the others, Chloral produced improvement after failure of Calabar Bean.
Do.	Do.	Do.	D.	
Do.	Do	Do.	D.	

Thus out of the thirty above recorded cases there were 22 recoveries, and 8 deaths showing a mortality of nearly 27. Per Cent Adding to these the 23 cases previously mentioned, and my own two cases, we get a total of 55 cases with 11 deaths. giving a

giving a percentage mortality of 20 which it will be seen does not differ very widely from that of the thirty cases I have myself collected.

I cannot here omit a remarkable case recorded by Aré, in "Comptes Rendus" LXXVIII. p 575. In this case one of severe traumatic tetanus, Aré performed the bold experiment of injecting 9 grammes of chloral hydrate into the veins. The result was to produce cessation of the spasms with deep narcosis and complete cutaneous anaesthesia. The effect of the dose continued for a long period, and the patient was completely cured by three large intra-venous injections, no inflammation or irritation of the vein being produced.

In conclusion I can only remark that although, as in all statistics culled from similar sources, the result found is more favourable than the actual facts of the case. Yet it appears to me indisputable that in Chloral Hydrate we

we have a drug which can record more successes in this disease than in any other remedy in the pharmacopoeia, And that the evidence we have on the subject is such as to induce us to press the drug boldly in all cases that come under our notice from whatever cause arising.

Bibliographical Appendix

Forbes' "manual select medical Bibliography" London. 1835. page 331. gives 44 references to treatises and monographs relating to tetanus, ranging from 1708 – 1835.

Hippocrates. Adams' translation for Sydenham Society 1849. p 326 & p 738.

Billroths Surgery. New Sydenham Society translation. Vol II p 68.

Wilks and Moxon, Pathological Anatomy p 252 and p 609.

Erichsens, Science and art of Surgery 7th Edit. 1877. Vol I p 12. & p 904. Vol II p 144.

Holmes. Treatise on Surgery. 1875. p 54.

Druitt. Surgeons Vade-Mecum. p 351.

Ranke Reid Reaction of nerves after tetanus. Centralblatt for 1868

Bruchow. Bromide of Potassium in tetanus. Gazette des Hôpitaux No 61. 1869.

Brown Robert. Bromide of Potassium in tetanus. Edin. Med. Journal. May 1869. p 993.

Macarthur. Calabar Bean in tetanus Edin. Med Jour. May 1869. p 989.

Holthouse. two cases treated by Calabar Bean one fatal, one recovered. Chir. Soc. Transact. II. p 94 - 103.

Haining. Case successfully treated by Calabar bean. Lancet Dec. 18th 1869.

Ogle. Division of nerves in tetanus Med. Chir. Review. Apr. 1869.

Danilewsky. Diminished quantity of albuminoid compounds in muscle in tetanus. Centralblatt. No 28. 1872.

Albut Clifford. Four cases. Pathological appearances. Path. Soc. Trans XXII. 147.

Joffroy. Microscop. exam. cord, nerves, and pons. in traumatic tetanus Gaz. Med. No 4. 1871.

Macaall. "Tetany" Glas. Med. Jour. III. p 459.

Black. Case treated by Calabar Bean (fatal) Br. Med. Jour. 1871. I p 220.

Bailey. Tetanus neonatorum, considers due to bad treatment of cord, Americ Jour. Obstet 1871.

Riegel. Tetanic symptoms from tape worm. "Deutsche Archiv" XII. 399.

Bourgeois. Esperiments proving increased temperature in tetanus due to production of heat in muscles. Gazette Med. 1873. p 350.

Callender. Case of nerve stretching in tetanus. Clin. Soc. Trans. Vol VII. p 100.

Remarks on nerve stretching in tetanus St. Barthol. Hosp. Reports. Vol XIV p 193.

Haddon, J. Puerperal tetanus.
Edin. Med. Jour. 1873-1874. p 34.

Annandale. Case of tetanus cured by excision of cicatrix. Edin. Med. Jour. 1873-1874. p 400.

Cases of nerve stretching and Amputation
Edin. Med. Jour. 1873-1874. p 459.

Delamarguay. Cure by intra-muscular injection of Muriate of morphia
Gazette des Hôpitaux No 88. 1872

Craig, William. Dr. Puerperal Tetanus
Edin. Med. Jour. 1870-1871. p 24.

Bourneville. Calabar Bean in Tetanus
Gazette Med. de Paris. No 8 - 1879.

Carrington and Wright. Lesions in cord in case of tetanus.
Guys. Hosp. Reports. 1879. p 185.

Eaton, J. Case of recovery of tetanus
Lancet May 10th 1879.
Woods Arthur. L. Contribution to
Pathology of tetanus. Lancet. Sept 7th 1878.
Kanat. D. J. Supposed idiopathic, found
to be traumatic tetanus. Lancet. apr. 23. 1878.
Juxford. A. M.D. Tetanus from Wasp
Stings. Lancet. apr 16. 1878.