**A lecture on the situation of the large blood-vessels of the extremities; and the methods of making effectual pressure on the arteries, in cases of dangerous effusions of blood from wounds: delivered to the scholars of the late Maritime School at Chelsea; and first printed for their use / [Sir William Blizard].**


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Thomas Howell

Surgeon

6th July. 1810.

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J. Howell. 1809.

# LECTURE,

On the Situation of the large Blood-Veſſels of the Extremities; and the Methods of making effectual Preſſure on the Arteries, in Caſes of dangerous Effuſions of Blood from Wounds:

DELIVERED TO THE SCHOLARS OF

THE LATE MARITIME SCHOOL AT CHELSEA;

*And firſt printed for their Uſe.*

THIRD EDITION.

TO WHICH IS NOW ADDED,

A brief Explanation of the Nature of *Wounds*,

More particularly thoſe received from FIRE-ARMS.

BY WILLIAM BLIZARD, F.R.S.

*Prodeſſe quàm conſpici.*

LONDON:

Printed by H. L. GALABIN, Ingram-Court;
and publiſhed by C. DILLY, Poultry.

1798.

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*IT is the duty of every man to be ready to meet the enemies of peace, order, and happineſs; but, while preparing to aſſume all the noble Britiſh character, through which, under Divine Providence, our matchleſs conſtitution and unparalleled bleſſings have been acquired and continued, let us not be unmindful of thoſe means of preſervation, in ſituations of danger, that Science and Art direct, of which the following are at all times proper to be underſtood, and eſpecially at the preſent moment.*

Devonſhire-Square,
April 30, 1798.

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# PREFACE.

THE INTRODUCTION prefixed to theſe pages, when firſt printed for the uſe of the ſcholars of the late MARITIME SCHOOL at Chelſea,* explains their original deſign. A paſſage in Captain DRINKWATER's Account of the Siege of Gibraltar, expreſſes the probable utility of ſuch a publication. —— "September, 1781. The 30th, a ſoldier of

* An inſtitution intended for the maintenance and nautical inſtruction of the ſons of thoſe naval officers who had bravely fallen in the ſervice of their country, without a proviſion for the ſupport and education of their children. The failure of this undertaking is to be lamented as a national misfortune. May public ſpirit ſoon revive the humane and patriotic deſign; to remain a monument of regard for thoſe objects that ought to be held moſt dear by Engliſhmen!

" the 72d. loſt his legs by a ſhot from " Fort *Barbara*. He bore amputation " with prodigious firmneſs; but died, ſoon " after, through the loſs of blood pre- " viouſly to his being brought to the hoſ- " pital. This fact being repreſented to " the governor, the ſergeants of the dif- " ferent regiments were ordered to attend " the hoſpital, to be taught by the ſur- " geons how to apply the TOURNIQUET; " which was afterwards productive of very " beneficial conſequences. Tourniquets " were alſo diſtributed to the different " guards, to be at hand in caſe of ne- " ceſſity."*

Were the knowledge of the ſituation of the blood-veſſels of the extremities, ſo far as is neceſſary for checking dangerous effuſions of blood, and the uſe of the tourniquet, more general; not confined to the navy and army, but extended to colleges and ſchools, particularly military and

* Vide Drinkwater's Hiſtory of the Siege of Gibraltar, p. 190.

nautical

nautical academies, manufactories, hoſpitals of every deſcription, priſons, plantations, fire-offices, the clergymen of pariſhes in which no ſurgeons are reſident, commanders of merchantmen, miners, &c. it could not fail of proving highly beneficial to mankind.

The late Sir BARNARD TURNER would have bled to death, on the ſpot of his accident that terminated fatally, had not compreſſion been inſtantly made on the artery of the wounded limb. Laſt winter, a poor man, in Cornhill, actually bled to death, from a ruptured veſſel in his leg, for want of the timely application of a tourniquet. —— But the experience of moſt perſons could afford inſtances of danger or death through defect of this knowledge.

When a fellow-creature is reſtored from a ſtate of apparent extinction of life by drowning, rewards are aſſigned to thoſe who exerted themſelves in the recovery. The knowledge of the means proper to

be employed on ſuch an alarming occaſion is alſo, very humanely, generally propagated. Surely, then, if men be in earneſt in their endeavours for the preſervation of human life, they will admit the importance of the information here recommended; ſince there is no doubt that many have fallen ſacrifices to ignorance of the means of reſtraining HÆMORRHAGE.

The familiar form of the Lecture is retained, as the beſt for general information.

*July* 30, 1786.

INTRO-

# INTRODUCTION.

FROM reflection on my duty, as SURGEON to the MARITIME SCHOOL, and a ſincere regard for the objects of my care, I propoſed to teach them the ſituation of the large blood-veſſels of the extremities, and the application of the TOURNIQUET. This I attempted, in the plaineſt manner in my power, in the way of LECTURE, as the moſt familiar and effectual method of impreſſing truths on juvenile minds: and it was pleaſing to obſerve the ATTENTION and FEELING expreſſed by my young auditors.

From a deſire to promote the great cauſe of the naval intereſt of my country, in that eſſential concern, THE PRESERVATION OF THE LIVES OF SEAMEN, I have now endeavoured to render my Lecture an uſeful OFFERING to theſe young warriors.

In

In the navy and army, caſes continually occur, in which the information it contains is abſolutely neceſſary for the preſervation of exiſtence: but there can hardly be a ſituation of life, in which, at ſome period, the knowledge might not prove of equal importance; and it cannot fail of adding to confidence and courage in the moment of danger.

But knowledge of this kind may be productive of ſome degree of good, though never *practically* required; for, SCIENCE ever tends to improve the heart, and raiſe the mind to contemplate the power, wiſdom, and goodneſs, of HIM THAT MADE US!

No profeſſional fame can be acquired from explaining facts known to every ſtudent in ſurgery. This little work muſt, therefore, be conſidered as a tribute to HUMANITY, offered from a ſenſe of duty.

*July* 15, 1783.

A LEC-

A

# LECTURE, &c.

YOUNG GENTLEMEN,

AS one of the guardians of your health and lives, I requeſt your attention, while I point out what may conduce to the preſervation of theſe bleſſings when you are launched into the world, as well as during your reſidence in this ſeminary of naval ſcience.

You are here educated to a profeſſion of great honour, becauſe of high utility. It is the ſecurity of our country, our religion and laws, our commerce and riches.

riches. The SEAMAN, then, according to his rank and merit, has a claim to the reſpect and care of his countrymen.

You are ambitious to become SEAMEN, are ready to join the veteran band, to go forth to fight the enemies of your country, and therefore merit the eſteem and ſervices of your fellow-citizens.

We are excited to attend to the welfare of the BRITISH SAILOR by another conſideration. Trained up in the principles of true honour and bravery, hardy in the practice of them, and properly conſidering his life as devoted to the ſervice of his country, he is leſs mindful of bodily evils, and the means of averting them, than the more wary and delicate landſman. He has a title, then, in generoſity, to that attention from others which a martial ſpirit prevents him from ſhewing to himſelf.

I am aſſured, gentlemen, that, in his majeſty's ſhips, you will have many occaſions

caſions for the exerciſe of your judgement and ſpirit reſpecting the health and lives of your men. You muſt *reflect for them*; and, when they find that you are truly zealous in all things for their good, they will obey with alacrity, will bear you with ſpirit through danger, and prove themſelves worthy of your generous regard. —— Theſe conſiderations will, I truſt, engage your attention to whatever promiſes benefit to your companions in war.

Every good and brave man would lay down his life in the diſcharge of his duty to his king and country. But, when ſick or hurt, he is not to neglect the means of relief which PROVIDENCE has afforded. On the contrary, we are commanded, by divine authority, to preſerve our lives and thoſe of our fellow-creatures.

For the preſervation of the health and lives of the officers and ſeamen of his majeſty's navy, there are appointed, by government,

government, to each ſhip of war, a SURGEON, and a certain number of MATES according to the rate of the ſhip. During the time of action, the ſtation of theſe officers is in the COCK-PIT. From their neceſſary confinement to this ſituation, evils of a very ſerious nature may ſometimes happen; for they cannot poſſibly render inſtantaneous aſſiſtance to thoſe in a remote part of the veſſel, whoſe bleeding wounds may urgently require the aid of ſurgery.

Some of the methods of chirurgical relief are very ſimple, though of the greateſt importance. Of this kind is the making an effectual temporary preſſure upon a part, to prevent a fatal effuſion of blood, in the caſe of wound, till means of permanent benefit can be employed.

Men of true courage are not diſmayed at the ſight of blood. In firm poſſeſſion of themſelves, on all occaſions, they are capable of exerciſing their judgement, and employing the means with which they

are happily acquainted, either to their own benefit or that of others. It is proper, then, that they ſhould have information of whatever is uſeful, and in their power to execute.

I cannot omit this opportunity, my young friends, of exhorting you to be EXAMPLES OF SOBRIETY as well as of the other VIRTUES. What advantage can flow from reaſon or courage in a ſtate of intoxication? Many a brave ſeaman has loſt his life from having his mind clouded, by the effects of ſtrong liquor, at the time of receiving a wound. — By TEMPERANCE the body is preſerved free from various diſorders, and the mind calm and firm, to direct under circumſtances of accidents and on every trying occaſion.

Induced by theſe conſiderations, I propoſed to the good men who direct your education, to teach you the application of the inſtrument, called TOURNIQUET, employed for ſtopping the flow of blood

from

from wounded veſſels. With their ſanction, I have the pleaſure of addreſſing you on this ſubject, and moſt heartily wiſh the inſtruction may prove uſeful.

A circumſtance has occurred, ſince I propoſed to meet you on this occaſion, which has ſtrengthened my notions reſpecting the utility of the intended explanations; and will, I have no doubt, be ſatisfactory to your governors.

I requeſted the ſentiments of an intelligent naval ſurgeon on the ſubject. This was his anſwer:

" I can beſt expreſs my opinion by " relating to you the practice of an in- " genious ſurgeon in the ſervice, and aſ- " ſuring you that his and my ſentiments " perfectly coincide. —— Mr. ****, ſur- " geon of the BARFLEUR, had obſerved, " with great concern, the dreadful effects " of wounds that happened in time of " action, from the ſeamen being entirely " ignorant of the manner of applying " the tourniquet, many inſtances having

" occurred

" occurred of men bleeding to death, par-
" ticularly in the tops, before aſſiſtance
" could poſſibly be rendered them. ——
" To prevent theſe evils, as much as
" was in his power, he provided every
" ſeaman, ſtationed in the tops, with a
" tourniquet; and, on every opportu-
" nity, taught them the method of ap-
" plying it; ſo that, in a ſhort time,
" they became perfectly expert in its
" uſe."

The pious Pſalmiſt beautifully exclaims, " I am fearfully and wonderfully made!" It would, indeed, require the ſtudy of a long life to learn the little that has been diſcovered of INFINITE WISDOM in the ſtructure of the ſeveral parts of the human body, and of INFINITE GOODNESS in the laws by which they perform their functions to the maintenance of health and life.

It is proper, however, that you ſhould have a general idea of the circulation of the blood, in order to underſtand the

practice that will be laid down, and to enable you to adapt it to particular caſes.

" In the BLOOD is the LIFE of man." That is to ſay, this fluid contains the principles of nouriſhment, and diſtributes them to every part of the body for its ſupply and refreſhment; like the water of the great ocean, which conveys the riches and good things of the world to every quarter of the globe.

The HEART is the ſource of this fluid. It is ſeated in the breaſt, a little to the left ſide; nearly, however, in the centre of the body. This organ is hollow, for containing the blood; and it has the power of contracting, and ſtrongly propelling its contents. By this contraction of the heart, the blood is puſhed forwards, with an exceedingly rapid current, to the remoteſt parts of the body; as the tide of the ſea influences and preſſes on the waters of rivers, obſervable here in the ſwelling Thames.

The

The veſſels, or tubes, which proceed from the heart, to convey the blood to all the parts of the body, are called ARTERIES. From the power with which the heart propels the blood through this ſyſtem of veſſels, it happens, that, whenever they are wounded, the blood flows rapidly and in jerks from the wounded part. They divide, to be diſtributed to parts, from trunks, like the branches of a tree from its body; ſo that, on preſſing together the ſides of any trunk, the flow of blood, into the branches beyond the compreſſed part, is prevented.

The veſſels, which return the blood to the heart, are named VEINS. The blood in them receives but little of the impelling force of the heart, and, therefore, moves not with a ſtrong tide or current, but glides evenly and gently on, like the ebbing water; and, conſequently, wounds of theſe veſſels are not of much importance: a ſmall degree of re-

 ſiſtance,

ſiſtance, by a finger, or ſome folded linen, applied to the wounded part, will generally ſtop the bleeding.

This tranſmiſſion of the blood from the heart through the arteries, and back to it by the veins, is the CIRCULATION; which was the diſcovery of our illuſtrious countryman, Dr. WILLIAM HARVEY.*

It

* The uſe of the lungs in the circulation is here purpoſely omitted. —— The reader, who is deſirous of enlarging his mind with the principal truths of anatomy and phyſiology, will be amply gratified in his inquiries. It is to be lamented that this kind of knowledge is not generally purſued as a part of a liberal education. The ſtudy of the animal economy affords the moſt beautiful and ſatisfactory ideas, and is calculated to prove highly beneficial to ſociety; for, it enables men to diſtinguiſh between ignorance and knowledge, and, conſequently, to encourage deſerving men, ſuppreſs quackery, and advance true medical ſcience. —— The medical books, that are frequently to be found in the libraries of gentlemen, are likely to produce very different effects. — The ſummary accounts of diſeaſes, with receipts for the cure of them, are pillars of the moſt dangerous empiriciſm: ſo

far

It is very plain, then, that, if a bandage or ligature be made ſufficiently tight around any limb, the flow of blood into all the parts below will be prevented. But, to render this effect certain, the preſſure muſt be very great in the whole circumference of the limb; and, in ſome caſes, from the ſituation of arteries between bones, the end cannot be obtained. To perform this proceſs, therefore, ſucceſsfully, in caſes of wounds and operations, and, at the ſame time, to prevent the evils of an exceedingly ſtrong *general* preſſure, ſurgeons have fixed on certain parts of the TRUNKS of arteries for the application of a pad or COMPRESS. — Theſe parts are expreſſed in the annexed plate.

The PULSE is the beating, or diſtending, of an artery, from blood propelled

far from furniſhing the mind with uſeful truths, they fill it with error, and beget a confidence in ignorance often fatal to health and life.

into it by the heart. The ſpaces of time between the pulſations are periods when the heart itſelf is diſtending with blood returned to it by the veins.

Now it is evident, that there can be no pulſation when the flow of blood and diſtention of an artery are prevented. Where, then, a pulſe can conveniently be felt, as in the wriſt, the ceaſing of it, from a preſſure made on the trunk above, will prove that the preſſure is made effectually. To illuſtrate this by an experiment: — Let a friend feel the pulſe in your wriſt; then apply two or three fingers in *the little pit, immediately below the collar-bone, cloſe to the ſhoulder, marked* a *in the plate.* Preſs ſtrongly, and the pulſe will ceaſe; becauſe, the artery that ſupplies the upper extremity *paſſes under the collar-bone, over the firſt and ſecond ribs, along this part*, and will be now preſſed againſt one of theſe ribs. Remove the fingers, and again apply them,

and

and the pulſe will be found to alternate with the preſſure.

Suppoſe, then, a wound to be received, an artery of a conſiderable ſize cut or torn, and a copious bleeding, in conſequence, to happen, in any part of the arm *below* the place *a*: — it is manifeſt, that, by making a preſſure with the fingers, in the manner deſcribed, or aſſiſted by a pad between the fingers and the part, the bleeding would inſtantly ceaſe. Is not this an uſeful remark? Let this little proceſs be your firſt exerciſe; and, when you are expert in the practice of it, we will proceed to conſider the other places in the limbs where effectual compreſſion may be made, and the inſtruments proper for the purpoſe.

The arteries of the upper extremity or arm proceed from the trunk at *a*, after this manner: *the trunk paſſes into the armpit, deeply ſituated; it then proceeds along the ſide of the arm, next the body, obliquely towards the fore part of the joint or*

*bend*, and here divides into three branches. In this courſe to its diviſion it lies near the bone, and may therefore be ſucceſsfully compreſſed. — The ſituation of this trunk to its diviſion is deſcribed in the plate by the lines *b*.

All compreſſive means, for preventing a flow of blood from wounded arteries of the upper extremity, muſt, therefore, be made either at *a*, or in ſome part of the courſe of the trunk of the artery, expreſſed by the lines *b*, *between the arm-pit and the bend of the arm*.

The diſtribution of the veſſels of the lower extremity is in this way. — The artery paſſes from the cavity of the belly to the GROIN, where, in thin perſons, the pulſation of it may be felt.

At this place, in caſe of wound and effuſion of blood very high in the thigh, effectual compreſſion may be made, by ſome fingers preſſed very ſtrongly, in the manner deſcribed for compreſſion below the collar-bone ; though it were better

to

to have ſome kind of ſtrong pad, or firm body, ſuch as will be deſcribed, interpoſed between the fingers and the part.

*From the groin, the artery proceeds in an oblique direction, downwards and inwards, as expreſſed by the lines* c; *and, at about the middle of the inſide of the thigh, expreſſed by the compreſs* d, *it lies cloſely to the bone.* This is the moſt favourable part for making a preſſure upon it, becauſe of the reſiſtance of the thigh-bone behind. And, where there are opportunities of choice, as in caſes of wounds or operations *below* this part, this is the place which ſurgeons fix on for the application of the compreſſing body; it therefore deſerves your particular attention.

The courſe of the veſſel is then *downwards and backwards to the* HAM; *in the hollow of which, againſt the lower flat part of the thigh-bone,** compreſſion may

* It is highly neceſſary, that the greateſt attention ſhould be paid to this point of inſtruction. The pad of the

may again be very ſucceſsfully made in all caſes of wounds or operations below the knee-joint. But *beyond* this part compreſſion muſt not be depended on; for, immediately below the joint, the artery divides, like that of the upper extremity, into three veſſels, which are ſituated between the bones of the leg.

You have, I doubt not, anticipated me in a remark on the goodneſs of the great CREATOR, in ordaining the ſituation of the larger blood-veſſels ſo that they ſhould not be expoſed to danger in the neceſſary offices of life.

the tourniquet being placed as here directed, the ligature muſt be brought *round the thigh, immediately above the knee*, and the twiſting, of courſe, be made upon the thigh. If, on the contrary, the pad be placed in the hollow of the joint, and the ligature carried round the leg, the conſequence might prove fatal before the error could be corrected. But it is generally more ſafe to make compreſſion in the middle of the thigh than at the part here deſcribed, and more proper as to effects afterwards; for, it is always right that the bruiſe and irritation that neceſſarily ariſe from the ligature ſhould be as diſtant as poſſible from the ſeat of injury or operation.

The

The inſtrument called TOURNIQUET, we are informed, was the invention of a ſurgeon, named MORELL, at the ſiege of BESANÇON. It conſiſts of four parts: *viz.* 1. *e*, a yard and half of ſtrong worſted, or other kind of band, an inch broad; 2. *f*, a pad of leather, tightly ſtuffed with wool or horſe-hair, two or three inches long, and of an inch breadth and thickneſs, having a loop on one ſide for the band to be ſlided through;* 3. *g*, a piece of ſtrong leather, three inches long and two broad, having two apertures, an inch aſunder, for paſſing the band or ligature; 4. *h*, a piece of ſmooth, round, and ſtrong, wood, about four inches in length.

Deſcription often fails even in things of great ſimplicity. This may poſſibly be the caſe in the account of the TOUR-

* It has been ſuggeſted, that, for the uſe of perſons who may not retain an accurate remembrance of the ſituation of the veſſels, it were better for this pad to be made as large again as here deſcribed.

NIQUET; but the ſlighteſt view will make it underſtood.* The manner of applying it is this. — Place the pad upon the proper part of the artery to be compreſſed; bring the band, paſſed through the loop of the pad, round the limb, and carry the ends through the apertures in the leather; make a double knot with the ends, leaving a ſpace between the knot and the leather that will admit three or four fingers; through this ſpace paſs the ſtick, and with it twiſt the ligature ſufficiently tight to ſtop the flow of blood through the artery into the limb. The leather, knot, and twiſting, are to be placed and made upon the upper part of the limb, nearly oppoſite to the compreſs.

* It is much to be regretted that this inſtrument is not generally known, and kept in every family. The price of it is too trifling to be mentioned. — The life of a valuable gentleman in Hertfordſhire would have been lately loſt for want of it, if a ſurgeon had not providentially called at his ſeat in the moment of a dreadful effuſion of blood, from a wounded artery in his hand, occaſioned by the breaking of a bottle in a fall.

It is manifeſt that this proceſs, ſimple as it is, requires both hands for tying the knot; and, therefore, that you could not apply the tourniquet to your own arm without aſſiſtance. It is as plain, alſo, that it demands a conſtant application of a hand to the ſtick, as the ligature would otherwiſe inſtantly ſlacken.

To obviate the neceſſity of two hands, in regard to the arm, let the ligature be about twelve inches long, and have at each end a loop: proceed in its uſe exactly as already deſcribed; only, inſtead of making a knot over the leather, paſs the ſtick through the loops at the ends of the ligature, and then perform the twiſting.

To fix the ends of the ſtick, ſo as to prevent the ligature from untwiſting, and the conſtant application of a hand, faſten a portion of tape or packthread, by means of a hole, at each end of the ſtick; carry the two pieces round the limb, and ſecure them by tying or pinning. — Many other

expedients

expedients may be contrived to anſwer this purpoſe.

Beſides the tourniquet that I have deſcribed, there is another, an excellent piece of machinery. It was invented by M. PETIT; and improved by the late Mr. FREKE, of St. Bartholomew's Hoſpital. It need only be ſeen to be underſtood. —— The pad, *i*, being placed upon the artery, and the ligature buckled at *k*, then, by turning the ſcrew, the upper moveable portion, *l*, will be raiſed from the lower, and, conſequently, the ligature may thus be drawn to the degree of tightneſs required.

The advantages of this inſtrument are very great. — It may be applied with only one hand; and, on being fixed, will remain ſafely in that ſtate without attention.

Thus the defects of the former inſtrument are ſupplied; and, on every occaſion for a tourniquet, *when there is a want of* ASSISTANTS, nothing more uſeful

was

was ever contrived. The ſurgeons on-board ſhips of war, in the hurry of engagement, oftentimes cannot poſſibly perform their neceſſary operations ſo ſoon as required: by this machine, the bleeding from wounds can inſtantly be reſtrained, and then the wounded may wait, without danger, till the ſurgeons can calmly execute their duty.—Government have wiſely directed every ſhip to be ſupplied with many SCREW-TOURNIQUETS.

And now, young gentlemen, after what has been ſaid of VESSELS and TOURNIQUETS, ſuppoſe any of you were wounded by a penknife, or other thing, in the thigh, leg, or arm, and, a large artery being punctured, a violent bleeding ſhould enſue. You have no tourniquet; but you clearly underſtand what has been taught on this ſubject. How, then, would you act?—Undoubtedly you would inſtantly pull off your garter, or take the firſt piece of ſtring or cord you could find; roll up your handkerchief hardly, and lay it on the

trunk

trunk of the artery above the wounded part; paſs the garter or cord over the handkerchief and round the limb; tie a knot, leaving a proper ſpace; and then twiſt the ligature by a piece of your ſtick or cane, or any other firm body you could procure.

It may be truly ſaid, that, in either of the branches of medicine, "a little learning is a dangerous thing." My ſole deſign was, to explain to you the means of ſtopping a flow of blood from wounded limbs, and preventing fatal conſequences, *till more effectual aid from ſurgery be obtained.* It is happy for mankind that there are profeſſors in this ſcience in almoſt every town and village, as well as appointed to the army and navy.

A BRIEF

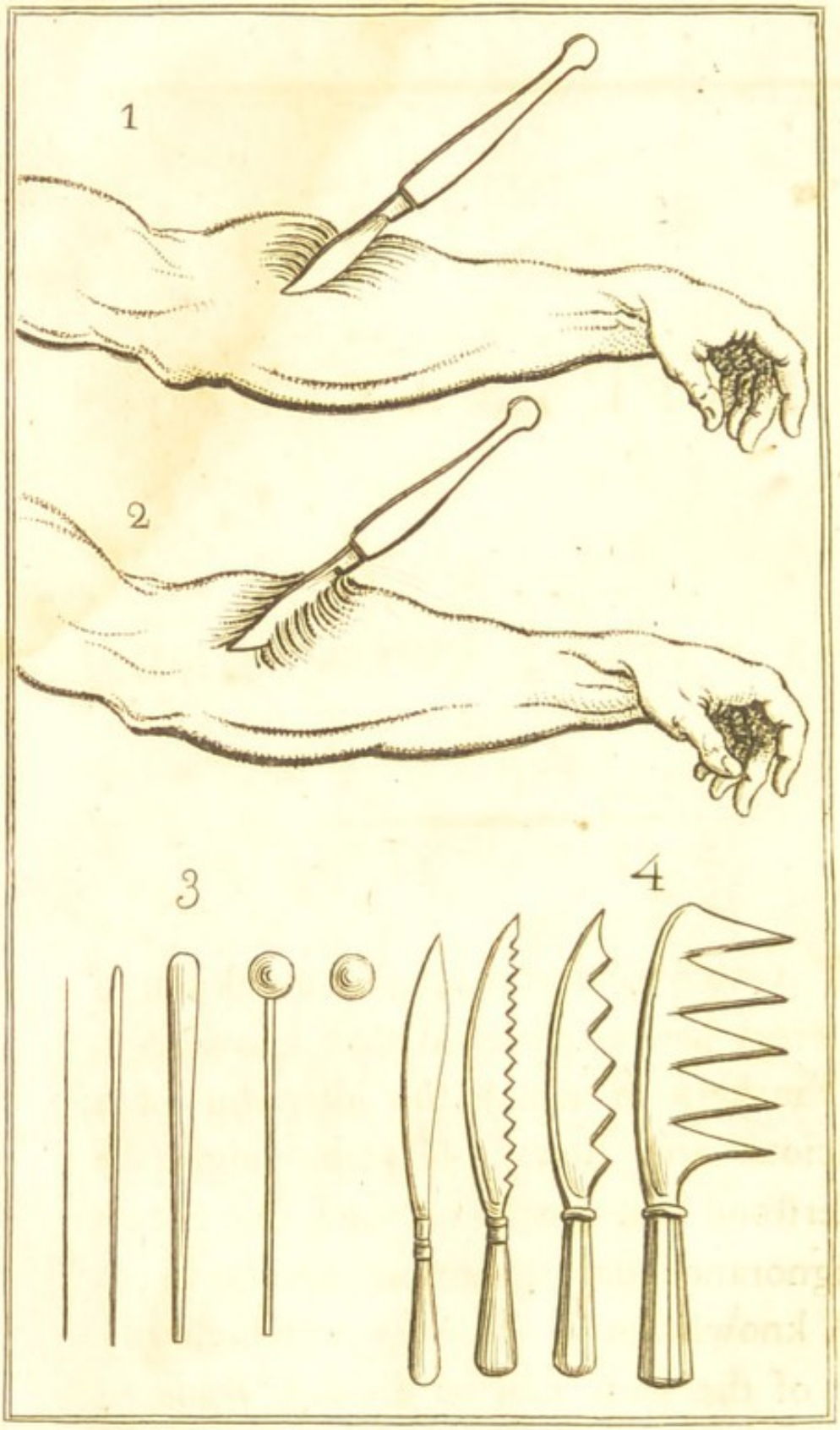
# EXPLANATION

OF

# THE NATURE OF WOUNDS,

MORE PARTICULARLY

*THOSE RECEIVED FROM FIRE-ARMS.*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A BRIEF

# EXPLANATION

OF

# THE NATURE OF WOUNDS.

IT would be fortunate for mankind, if every perſon poſſeſſed that knowledge, by the help of which the intention of a judicious and honeſt ſurgeon might be underſtood and promoted, and the effects of ignorance and impoſition prevented.

A knowledge of the ways in which any part of the body can be divided, leads to

that of the nature of wounds; and this information, added to a very little acquaintance with the animal economy, points out the manner in which ſuch ſpecies of injury ſhould be treated.

The terms of diſtinction applied to wounds will be more clearly underſtood from conſidering the manner in which they happen.

Conceive, then, the acts of dividing the fibres of an animal body by an inſtrument moving in a direction either perpendicular to the ſurface of the fibres, or parallel to it.

In the former caſe, the inſtrument, of whatever deſcription, muſt be preſſed perpendicularly to the ſurface; from which preſſure, the fibres will be more or leſs ſtretched; bruiſed in a maſs together, proportionably to the extent of the preſſing body; and, laſtly, broken through in a perpendicular direction. *(Fig. 1.)*

In the latter caſe, the inſtrument muſt have teeth. Theſe teeth muſt be made to

enter

enter into ſpaces between ſome of the fibres; or they muſt preſs down ſome fibres, while others riſe into the intervals of the teeth. The inſtrument being then drawn in a direction parallel to the ſurface, there will be a yielding and ſtretching of the fibres, till they can yield and be ſtretched no farther; and then they will be broken through in a parallel direction. *(Fig. 2.)*

Hence are derived elementary ideas of every ſort of wounding inſtrument, and of every diſtinction of wound.

Suppoſe, for illuſtration, a ſeries of inſtruments, placed in regular order, beginning with the fineſt needle, and ending with a ſtick having a leaden bullet fixed to its extremity. Then figure to the mind the ſame bullet, unconnected with the ſtick or any other body. Imagine, in the next place, a wound produced by any one of theſe inſtruments, in a ſimilar way, by preſſing, bruiſing, and rending, the fibres of the part, perpendicularly to its ſurface. *(Fig. 3.)*

The wound produced by each of theſe inſtruments will be a *contuſed wound*; but the wound made by the needle will be ſtyled a *punctured wound*. Yet this very needle would fatally bruiſe a minute inſect. Whence we learn, that the technical terms *contuſed* and *punctured* are relative to the ſize of the inſtrument, and the tenuity of the part injured.

If the wound made by the bullet fixed to the end of a ſtick, by the force of an arm or otherwiſe, be a contuſed wound, it follows, that a wound cauſed by the ſame bullet, propelled by the force of gun-powder, will alſo be a *contuſed wound*, without any difference whatever, ſave what may ariſe from greater force or *momentum*, through greater velocity, and from its ſeparate ſtate, on which account it may be made to penetrate, and may be reflected, differently from what can happen while fixed to a ſtick held by a hand.

Suppoſe another ſeries of inſtruments, placed in the ſame regular order, beginning

ning with the fineſt knife, and terminating with a row of ſpikes. Then conſider the analyſis of a knife. It conſiſts of many pointed teeth or ſpikes; thus it anſwers to the character of a ſaw; and, as graduating from the back to the edge, it poſſeſſes the principle of a wedge. As the edge is more or leſs finely graduated, and the points are more or leſs ſmall, ſo is the knife expreſſed as more or leſs keen. *(Fig. 4.)*

Conceive, now, a wound to be made, by each of theſe inſtruments, upon the principle of a cutting inſtrument. The points of each muſt be preſſed down between the fibres, and next drawn in a direction parallel to the ſurface, as has been explained.

But how different, in many reſpects, will be the wound made by the fine knife, and that occaſioned by the ſaw, or inſtrument with ſpikes. The wound made with the leaſt conceivable ſtretching or bruiſing effect, is called a *ſimple inciſed wound:* as that made by the hand of a ſurgeon with a fine

knife ; in which caſe, it is gently preſſed as a wedge, ſo as to paſs the points of the edge into the ſpaces between the fibres to be divided, and no more ; the inſtrument is then drawn in a direction parallel to the ſurface ; the tender fibres are thus broken ; and, by repeated applications and drawings of the knife, ſucceſſive layers of fibres are divided to the extent required. — The one attended with much violence of effect, from the reſiſtance of the fibres, as that made with a jagged inſtrument, is termed a *lacerated wound.*

But, when we conſider the graduation of the ſharpeſt knife into the ſpiked inſtrument, and that, in wounding with each as a cutting inſtrument, the ſame proceſs takes place, theſe terms alſo will appear relative, to the fineneſs of the inſtrument, and the delicacy of the ſubject divided. ——— That which might be expreſſed as a *ſimple inciſed wound*, in the ſide of an elephant, would probably be a dreadfully-lacerated one in the human body.

In

In *every* caſe of wound, preſſure and ſtretching muſt happen prior to diviſion of fibres, with whatever velocity of ſucceſſion theſe effects may be produced.

Stretching irritates fibres through their whole extent; as the ſtring of a muſical inſtrument is vibrated through its whole length by a force applied to any part of it. Diviſion ſaves from farther ſtretching; as the breaking of a vibrating ſtring deſtroys the continuity between its extremities, and ſets at reſt the ſeparate portions.

The effects of irritation are pain; inflammation, and its conſequences; convulſion; delirium; ſpaſm; and locked jaw.

Proportionably to the degree of the irritation; the irritability of the wounded part, and the body generally; will be theſe effects, up to death.

Contuſion always implies ſtretching and irritation, and alſo death of parts. The effects of irritation, and detachment or ſloughing of dead parts, conſequently follow.

The

The proceſs by which divided parts are united, and parts loſt are ſupplied, is univerſally the ſame.

The agents are the abſorbent-veſſels and the arteries. The former labourers being employed in conveying particles away; the latter in bringing and depoſiting matter of ſupply.

There can be no union of divided parts without a medium of new ſubſtance. The expreſſion, therefore, of a union *ſine medio* is founded in error.

A glutinous matter is produced by the extremities of the divided arteries; its properties being, in ſome degree, determined by the irritation of the hurt.* Minute veſſels, of the three ſpecies, (*viz.* arteries, veins, and abſorbents,) ſhoot into this glu-

* So that a wound, hypothetically admitted without irritation, would want the neceſſary *ſtimulus* to the early ſteps of union or ſupply. In this remark, however, we have only a particular illuſtration of a beneficent general law reſpecting the preſervation of every part, and of the whole animal fabric.

ten,

ten, and increaſe, till the maſs becomes duly organized for the end required; and the veſſels of the ſkin have, according to their nature, formed a cuticle or *cicatrix*.

The veſſels thus produced fix the ultimate ſtate of the new-organized ſubſtance, according to the diſpoſition of the veſſels they are extended from. Thus, if the diviſion be of bone, they will ſecrete bony matter, and form a union by what is termed *callus*; and, according to the ſtructure and functions of the various other parts of the body, will be the denſity, reſiſtance, flexibility, &c. of the medium of union, as in muſcle, tendon, ligament, cellular ſubſtance, membrane, ſkin, &c.; only it muſt be obſerved, that no part is united or ſupplied with a ſubſtance poſſeſſing the original characters of the part ſeparated or divided, excepting cuticle.

In a ſimple inciſed wound, if the ſpace between the divided fibres be very inconſiderable, if there be no extraneous body in

that

that ſpace, if irritation and inflammation be not ſo great as to produce *pus* or matter, then may the ſides unite by what is called the *firſt intention*, or, very properly, *agglutination*; for, they are truly, in the firſt place, glued together.

The objects of ſurgery, then, in a ſimple inciſed wound, are, to reſtrain irritation and inflammation; to remove extraneous matter; and to bring and retain the ſides in contact.*

Bleeding,

* The leſs the quantity of uniting medium, the leſs liable it will be to change afterwards; the ſtronger will be the union; and the more perfect, in every function, will be the united part. The circulation in a new ſubſtance is never ſo ſtrong as in a part originally formed: whence its veſſels are leſs capable of ſuſtaining the influence of cauſes productive either of ulceration, by occaſioning the abſorbents to convey away loaded and oppreſſed parts; or of death and ſloughing, through obſtruction by preſſure upon the returning veins and abſorbents.—The breaking of the *cicatrices* of wounds and ulcers, the conſequence of many cauſes affecting the veſſels beyond what they can bear, are illuſtrations of this poſition.——When it is deſigned to unite by the firſt intention, care ſhould

Bleeding, purging, injection, and low regimen, are proper in the firſt intention; adheſive plaſter, bandage, bolſter, ſuture, and, above all, *poſition*, in the laſt.

It muſt be manifeſt, from the nature of what is denominated lacerated wound, that it will be attended with great irritation; the effects of which are, therefore, to be guarded againſt by opium, in addition to the other means mentioned, indicated alſo in this caſe. Fomentation of warm water, bread and milk poultice, or poultice of decoction of poppy-heads and linſeed-meal, are proper for the purpoſe of allaying irritation and pain.

ſhould be taken that the divided ſides are, in every part, brought into accurate contact. It were better that a chaſm ſhould be left near the ſurface, than that the ſuperior parts ſhould be united, while a hollow is left beneath, that will become the ſource of future pain and trouble. Nicety in the application of the edges of the ſkin, however proper with a due regard to the deeper parts, is not, therefore, of ſo much importance as the coaptation of the ſides from the bottom of the wound.

If

If a muſcle, the fibres of which are united in one tendon, be partially divided, the effects will probably be more violent than if the whole were cut through.

In the caſe of a punctured wound, (by a ſmall ſword or bayonet for inſtance,) no inquiry into its depth or penetration ſhould be made, by probing or otherwiſe. Gratification of curioſity, in this caſe, may prove fatal, but never can be productive of the leaſt benefit. Life will often depend entirely upon immediate agglutination; to promote which, all the means propoſed for preventing and removing irritation and inflammation ſhould be rigidly employed. A probe would break down the tender glutinous medium, and irritate the ſenſible extremities of the divided veſſels, upon whoſe gentle action ſucceſs altogether depends. — There is no caſe in which attention to poſition is more required than in this; and it ſhould be remembered that no part about the trunk can be at reſt otherwiſe than in a recumbent ſituation.

In

In every contuſed wound, there is an object to be regarded, in addition to what occurs in other diſtinctions of wounds; namely, the ſeparation of dead parts. This proceſs being very weakening, reduction of the ſtrength, by bleeding, &c. ſhould not exceed what is abſolutely required on account of an exceſſive *degree* of irritation and inflammation. Soothing means, as fomentation of warm water, and poultice with milk or decoction of poppy, are generally proper.

In every gun-ſhot wound, then, there is death, and muſt be ſeparation, of parts.

According to the *momentum* of the ball, and the reſiſtance it meets with in its progreſs, ſo will reflection more or leſs readily happen; and reflection will, of courſe, be determined by the angle of incidence.

Perſons, ignorant of the reflections that are produced upon bullets paſſing into or through any part of the body, have concluded very falſely concerning the parts injured in gun-ſhot wounds; and, upon the foundation

dation of ſuch miſtakes, many marvellous ſtories are related.

Balls have been reflected round the body, without penetrating the *peritonæum*, or membrane that lines the cavity of the belly, and without perforating the *pleuræ*, or membranes that line the cheſt; and have then either lodged, or paſſed out at an oppoſite part. The like events have happened reſpecting the ſcull and its contents. Even a whole charge of ſlugs, from a blunderbuſs, has penetrated one ſide of a knee-joint, paſſed round the knee and through the oppoſite part, without injuring the articulation.

In any ſuch like caſe, it is not unuſual haſtily to conclude, that the ball has gone through the bowels, or the brain: and the laws of the animal economy have been thence miſinterpreted.

It is a vulgar error, that the contents of fire-arms do no harm when diſcharged cloſely applied to the body.*

When

* This opinion was, however, ſeemingly aſſented to a few years ago, at the Old Bailey, in the trial of Dr. Elliot

When a bullet penetrates a flexible part, it ſeldom happens that any portion of the ſubſtance is detached inwards before the ball; for the divided extremities of the fibres, at the point of rupture, are bent, and yield to the paſſing body. The fibres afterwards recover themſelves, according to their degree of elaſticity, from their curved ſtate, and preſent an aperture bearing but a ſmall proportion to the ſize of the ball. This is moſt remarkable in a muſcular or fleſhy part.

When, however, a ball penetrates an inflexible body, as bone, the effect is different: a portion of the ſubſtance penetrated is forced inwards before the ball. — If a bullet paſs through a hard body, it will ſplinter and ſcale the ſurface of its egreſs; while that of its ingreſs preſents an

hot for ſhooting at a lady. In conſequence of which, experiments were made to aſcertain the truth in this matter. The reſult was, (as common obſervation and common ſenſe led to ſuppoſe,) the nearer a piſtol or gun is applied to any part, when fired, the greater is the effect.

opening nearly correſponding with the ſize of the bullet. This is illuſtrated by the effect of a cannon-ball that has paſſed through the ſide of a ſhip, the ſplinters from which are ſo dreadfully deſtructive. Every caſe of fracture of the ſcull affords alſo ſome degree of illuſtration. Such fracture happens from a force applied to the part itſelf; and the portion of bone beaten inwards, will always be ſcaled or fractured farther in the internal than in the external ſurface.

In every inſtance effects will vary, according to circumſtances of reſiſtance in the ſubſtance penetrated; the figure, and obliquity of direction, of the body penetrating; &c.

In every caſe of gun-ſhot wound, whether in a yielding or an unyielding part, extraneous matter may be forced inwards.

There is nothing more myſterious, then, in gun-ſhot wounds, than in the other diſtinctions of wounds: the *phænomena* of them

them all are explicable by the ſame laws of Nature.

There are occaſions for the aid of ſurgery, when advice and aſſiſtance from afar cannot be obtained ; when *inſtant* deciſion, *immediate* means, are neceſſary for preſerving life. Of ſuch a nature, generally, are wounds from fire-arms. A leſſon this to young ſurgeons who enter into the ſervice of the army or navy, in the hope of riſing to ſituations of the moſt ſerious reſponſibility.

There are *two* periods, reſpecting HÆMORRHAGE in gun-ſhot wounds, to be particularly regarded. Through the laceration of large blood-veſſels, a fatal effuſion may *inſtantly* happen, if not prevented, at firſt, by the tourniquet, or other compreſſive means; and next by ligature, operation, &c. —— The ſecond period is, when the bruiſed and dead parts begin to ſeparate, or ſlough away. Openings into veſſels, and dangerous hæmorrhage, may thence ſuddenly happen ; ſo that, in caſes where,

from the circumſtances of the wound, ſuch an event is apprehended, it is to be guarded againſt in the moſt cautious manner.

There are *two* periods, alſo, in gun-ſhot wounds, when endeavours to extract foreign bodies are proper: — Firſt, immediately after the accident, before ſwelling has taken place; and, ſecondly, when tumefaction, from irritation and inflammation, has ſubſided by ſuppuration.

Enlargement of the wound, when it can be ſafely done, or an opening at a diſtant part near which the ball is felt, will often be leſs injurious than repeated introductions of the forceps into the wound made by the ball.

When a ball is lodged out of obſervation, either in the brain or in any part within the belly or cheſt, it is not to be blindly ſought after. Meaſures beſt calculated to prevent evils, from the preſence of the extraneous body, are immediately to be adopted. Effects are then to be watched, and made the guide of future conduct.

MR. RANBY's book on gun-ſhot wounds contains many valuable obſervations, and is written with great ſincerity; but its general doctrines are either unfounded, or not clearly conveyed. The practice of dilating generally, for inſtance, is not warranted by reaſon or experience; and the effects of bleeding, and of the bark, are not peculiar and ſpecific in this caſe, as might be thought from the tenor of the work; but are to be accounted for upon thoſe known general principles by which ſymptoms and their remedies are explained.

Dilatation of the wound ſhould be made only when plainly required. It may be neceſſary at two periods of time, namely, immediately after the hurt, for the more ready extraction of the ball, or any other thing that may have been forced into the part; for the more effectual making of ligature, in the caſe of hæmorrhage; and, ſometimes, for the ſake of dividing a muſcle entirely:—and after ſuppuration, when the ſame reaſons may call for it as at firſt;

and when, beſides, a free exit to matter becomes indiſpenſably neceſſary. On the laſt account, dilatation may frequently be uſeful; for, as the wound is generally zig-zag, through the different degrees of reſiſtance of parts, matter is very liable to be retained, and, conſequently, to require expedients for its diſcharge. From the beginning to the end, every cauſe of irritation is to be avoided. Operations of any kind are allowable only as far as they promiſe obvious definable benefit.

Applications to the part ſhould be ſimple and eaſy. Fomentation, and poultice with milk or decoction of poppy-heads, will, at firſt, be moſt proper; and, when ſuppuration is eſtabliſhed, and the veſſels need moderate excitement, a poultice of porter and oatmeal will probably be as good an application as can be employed.

Wounds from fire-arms are practically diſtinguiſhable into two ſtages; the firſt terminating, and the ſecond commencing, at the period of ſuppuration.

During

During the firſt ſtage, the violence of ſymptoms of irritation and inflammation is to be moderated by bleeding, purging, ſmall doſes of antimony, opium, diluting draughts of watery drinks, &c. *Bleeding* ſhould, however, be allowed with the ſtricteſt regard to the pulſe, as expreſſive of the ſtrength of the body. It may be copious at firſt, eſpecially from the divided veſſels themſelves; but it ſhould be repeated rather in moderate quantities than largely. Topical bleeding, by leeches, will prove more immediately beneficial than by the lancet, and leſs weakening in its remote effects.

Inflammation, as neceſſary to ſuppuration, and the detachment of dead parts, *muſt* happen, for the event to be fortunate. If, therefore, the ſtrength be ſo reduced that inflammation cannot be ſuſtained in a due degree, or for a ſufficient length of time, the termination will be fatal.

In every caſe of neceſſarily large detachment of parts, ſuppuration is to be looked

for as an event of the utmoſt importance. Indications will then inſtantly change, and upon anſwering them in time will depend principally the iſſue of the caſe: for, as, during the firſt ſtage, means for keeping inflammation within proper bounds are neceſſary; ſo, when inflammation has terminated in ſuppuration; when pain, the conſequence of ſtrong action of veſſels and tenſion of parts, and fever, have ceaſed; when theſe ſymptoms are ſucceeded by a ſinking pulſe, general ſenſe of weakneſs, diſcharge of matter, and fall of ſwelling, in the ſeat of injury; the lowering means are immediately to give place to thoſe of oppoſite tendency, — to bark, ſmall doſes of opium, good aliment, ſpice, wine, porter, &c.

It, indeed, ſometimes happens, from a previouſly weak ſtate, or hæmorrhage from the wound, that the ſtimulants juſt mentioned are neceſſary from the very beginning. So far from inflammation riſing to too high a point, it cannot be raiſed to, or

retained

retained at, a proper height for all the ends required, through the inflammatory action of the veſſels. This is, indeed, a ſituation of great peril, and calls for the niceſt attention; for, excitement, beyond what the circumſtances of the moment demand, will prove, in effect, a waſte of vital power. The minutes, therefore, muſt be watched; and according to what they bring forth muſt be determined the adequateneſs of remedies.

AMPUTATION is to be performed only under circumſtances, unequivocally expreſſing it to be neceſſary for the preſervation of life.

Events, in gun-ſhot wounds and compound fractures, ſeem to juſtify the aſſertion, that ſucceſs oftener attends amputation after ſuppuration, than when performed before that period.

There are, however, occurrences in theſe and other deſcriptions of caſes that at once determine the judgement as to the propriety of *immediate* amputation;

and,

and, independently of the hurt, abſtractedly conſidered, there are many things that will have great weight in deciding upon the operation as the beſt expedient, even when, *prima facie*, the nature of the injury may be ſuch as, under more favourable circumſtances, might juſtify a leſs ſevere deciſion. The ſituations of wounded people, in a crowded hoſpital, in an airy plain, in the field of battle, in a chamber of convenience and ſecurity, in the anxious moment of engagement, when in quiet poſſeſſion of the field or the ſea, during the hurry of a purſuit, the alarm of a retreat, &c. are very different, and will preſent reaſons for acting differently in ſimilar injuries.

General chirurgical principles, confirmed by experience, muſt, however, be adverted to, and ſhould be the guide upon every occaſion.

The more topical or limited the hurt, the more proper, generally, will be *im-*

*mediate*

*mediate* amputation; and, *vice versâ*. A wound, by a muſket-ball, in the ancle-joint, and one in the thigh, with fracture, from a cannon-ball, are caſes that illuſtrate this poſition. — It is the more neceſſary that an inexperienced perſon ſhould well conſider this rule, as the ſigns of the greater extent and degree of violence might otherwiſe be very likely to miſlead his judgement.

The operation ſhould be done completely beyond the ſeat of *contuſion*, as well as of fracture, &c. This plain rule, alſo, is of great importance: the utmoſt care, therefore, is neceſſary in determining upon the nature and boundary of the injury.

Gun-ſhot wounds in the joints generally require amputation.

In every caſe of wound of a large artery, it is ſafer to make a ligature upon each divided extremity, than to truſt to one only: branches may ſupply the lower

er portion, and continue or renew hæmorrhage.

The period of ſeparation of contuſed and dead parts muſt be religiouſly watched. The alarm of bleeding may happen when not expected from any *ſign* of contuſion; and life will conſequently depend upon immediate aſſiſtance. The retracting of a veſſel, or fainting, may ſuſpend hæmorrhage, that may afterwards occur, and prove fatal.

Whenever LIGATURE can be made in the caſe of an opened artery, it ought to be done. Nothing that bears the title of STYPTIC is to be *depended* upon.

Men ſhould be wary how they give their ſanction to dependence upon STYPTICS in preference to *certain* means of ſtopping hæmorrhage. A little matter will ſometimes ſuffice to reſtrain a bleeding. In an amputation of the leg, below the knee, of a boy eleven years of age, at the London-Hoſpital, all the arteries retracted

tracted ſo much that not a ligature was made, and he was ſoon well. If any thing called ſtyptic had been employed in this caſe, it would have acquired unmerited reputation, and the loſs of many valuable lives might have been the conſequence.

Reſiſtance to a flow of blood may be made by divers means, that may prove effectual in bleedings from *ſmall* arteries; but are always to be regarded as fallacious in diviſions of large veſſels.

Mealy, and tender fibrous, ſubſtances, united with the blood, may form a reſiſting paſte. Acids, ſpirit of wine, &c. may coagulate the blood, and ſo occaſion reſiſtance. Stimulating things may excite the extremities of divided veſſels to contract, and retract, and thence reſiſtance may be cauſed. Coagulation of the blood in the coats of a divided artery, as well as in the tube itſelf, and, conſequently, death of the veſſel, may happen from heat, and various things called cauſtics.

Solutions

Solutions of reſins may be decompounded by the blood in the part, and the reſinous coagulum may obſtruct the divided veſſels, as with the compound tincture of gum-benjamin, tincture of myrrh, &c.; and ſome of theſe properties may be united in the ſame article: but experience has demonſtrated the fallibility of all ſuch means.

Unhappily, however, there are occaſions where ligature cannot be made; and it *ſometimes* happens, that the trial of a ſtyptic may be admiſſible, even in caſes where ligature can be performed. Oil of turpentine, applied by buttons of lint, will generally prove the moſt effectual article of the claſs of ſtyptics: being made hot, its ſtyptical property becomes conſiderably augmented.

But, moſt of all, next to ligature, COMPRESSION is to be depended upon. This may be made by means of compreſſes of linen, lint, &c. either againſt the ends of the veſſels, upon their ſides, or in both ways.

ways. *Sponge* is admirably adapted for preſſure; but, when it is employed, the *rationale* of its uſe ſhould be remembered. The end purpoſed will depend upon its elaſticity. It is, therefore, to be ſo preſſed into, or upon, the part, as, when expanded, to maintain a proper degree of preſſure againſt the open veſſels.

Ligature may be made with the greateſt probability of ſucceſs upon any artery of the upper extremity; and upon any artery, below the ham, of the lower extremity; and there is ſome probability that ligature may be ſucceſsful below the large artery, called *arteria profunda*, that goes off from the artery in the groin: but no perſon is to be ſuffered to die by hæmorrhage that can be reſtrained, from any veſſel. What may *poſſibly* happen cannot be foretold. The very order of things, in the diſtribution of the veſſels in the part wounded, may be reverſed; and it ſhould be remembered, that the nouriſhment of the parts

below

below may be effectuated through the gradual dilatation of myriads of communicating ſmall veſſels, in the ratio of their diameters, where no large artery, that can itſelf carry on the circulation, exiſts.

The difficulty of effectually ſecuring bleeding veſſels increaſes much by the loſs of time; eſpecially, if irritating ſtyptics have been employed. The adheſions, thickening of cellular ſubſtance, &c. that follow, render it oftentimes no eaſy matter to aſcertain, and properly bring to view, the injured veſſel: nor is ſuch a ſtate ſo favourable for the event of a ligature as the condition before inflammation. Experience has proved it a ſafer general practice, in the caſe of puncture or diviſion of a large blood-veſſel, at once ſo far to extend the wound as to allow of tying the artery with eaſe and proper effect.

The elaſtic forceps are convenient for holding veſſels while ligatures are made upon them; but, in precarious ſituations, it is ſafer to uſe the needle and ligature;

ture; taking great care, however, to leave out diſtinguiſhable nerves. The *many-tailed* flannel bandage is the beſt for the thigh after amputation. By cutting off one of the portions of a ligature, the bulk of extraneous matter in a wound is favourably leſſened.

There is ſometimes a ſtate of dreadful apprehenſion, concerning operations, even in perſons of undoubted courage. An occurrence, ſome years ſince, at the London-Hoſpital, will expreſs this in a ſtriking manner, and may convey ſome inſtruction. A foreigner was to have his leg amputated, on account of a diſeaſe in it through which he was ſinking. He was ſo reduced, that it was determined to perform the operation on his bed. At the moment of proceeding to the inciſion, he ſuddenly raiſed himſelf, fainted, and fell backwards. He thus continued ſome minutes, with a pulſe barely perceptible. He then recovered a little, again ſtarted up, aſked,

" Is my leg off?" and, upon being told it was not, fainted again. It was judged, that he would inevitably die without amputation; that he would probably die from repeated fainting; that the operation, performed with due care as to loſs of blood, would tend to rouſe, inſtead of weakening, the action of the heart and veſſels; and that, therefore, it ought to be performed. It was done, with as much expedition as poſſible. —— The operation was entirely finiſhed, when he again raiſed himſelf, and put the queſtion as before. Being aſſured that his leg was removed, he inſtantly became cheerful, and fainted no more. He left the hoſpital perfectly well; and always declared, that he had not the leaſt painful ſenſation from, or conſciouſneſs of, the operation.

MORTIFICATION is the death of a portion of the body; and is the conſequence of any cauſe that puts a ſtop to the circulation of the blood in it. Thus the arteries

teries of a part, in an over-diſtended ſtate from inflammation, become incapable of acting upon, and aſſiſting in, the propulſion of their contents; whence the ſides of the veins, and abſorbents, are at length ſo compreſſed as to occaſion ſuch a degree of obſtruction and reſiſtance in them as the power of the heart is inſufficient to ſurmount: the fluids in the tubes, conſequently, become ſtagnant. In what manner the bruiſing of veſſels, coagulation of the juices by heat and other cauſes, ligature, &c. occaſion mortification, may thence be eaſily conceived.

It will, moreover, be plain, that a diminution of power in the heart, and in the veſſels of any part, may occaſion mortification; eſpecially if, at the ſame time, a more than ordinary degree of reſiſtance is to be overcome.

That mortification ſhould often follow gun-ſhot wounds, will not, therefore, appear extraordinary.

It is truſted, no ſurgeon need be told, that amputation will not check mortification: or that the operation is not admiſſible till Nature has ſaid, *Thus far, and no farther*; till, in ſhort, the line of ſeparation of dead parts is manifeſt. — There are alſo rules to be obſerved equally intereſting as this maxim.

SCARIFICATION cannot be of uſe, except in the dead parts, for the extrication of putrid air.

The application of oil of turpentine, or any other powerful ſtimulant, while inflammation is preſent, muſt prove injurious.

Although high action of the heart and veſſels may, for a while, be concomitant with mortification; and although, during ſuch a ſtate, the object of ſurgery is to cool and calm the heated ſyſtem; yet, ſooner or later, the powers will become depreſſed, and require all the aid of diet and medicine to ſuſtain them in their functions. In this ſtate, wine,

opium,

opium, and bark, are remedies principally to be depended upon. The two latter have been experienced of ſuch great efficacy that ſome perſons have aſcribed to them *ſpecific* virtue; thus ignorantly admitting mortification to be a ſpecific diſeaſe. They are beneficial in this caſe, upon the ſame principles as in debility from any cauſe whatever.

When topical excitement is called for, oil of turpentine, mixed with olive-oil, may be proper; but the natural terebinthinate balſams, as balſam of Copaivi, &c. are generally to be preferred.* Aromatic fomentation, with camphorated ſpirit ſprinkled over the flannels; and poultice of beer, oatmeal, and pepper in fine powder; and antiſeptics to the dead parts, as vinegar, diluted mineral acids, ſpirit of wine, tincture of myrrh, fermentative articles affording fixed air, &c. will be uſeful.

* *Camphor*, united with gum-arabic and water, in the form of mucilage, becomes an application very antiſeptic and kindly ſtimulative.

STIMULANTS, both external and internal, ſhould, however, at all times, be nicely graduated according to the effects which they produce. *Debility* in the moving fibres is the conſequence of action too long continued, too often repeated, and too ſtrongly performed; as well as of oppoſite ſtates, ariſing from torpor, or from defect of exciting power.

In mortification of a limb, when detachment becomes neceſſary, care muſt be taken that amputation be not deferred till the ſtrength is too much exhauſted.

The effects of wounds and contuſions from fire-arms are often felt at great diſtances of time from the infliction of the injury. The bones are frequently the ſeat of remote evils from thoſe cauſes. The *phænomena* of diſeaſed bone ariſe from the agency of their arteries and abſorbents; or from the death of theſe veſſels, their contents, &c. as in *neceroſis* or *mortification*. — The analogy of the changes in bone with thoſe in the ſoft parts

is exact in every particular. A dead portion of bone is ſeparated or *exfoliated* by becoming firſt inſulated from the living parts, through ulceration, by abſorbents; and then puſhed away by an organized ſubſtance, the production of arteries. — Sometimes, all the particles of a dead portion are removed by abſorbents; and the event of exfoliation is thence obviated. Nature often extends the growth of an organized ſubſtance very far, in order to apply her uſeful inſtruments, the abſorbents, to perform important offices; and, not unoften, her beneficent intentions are fruſtrated, in the deſtruction of this ſubſtance, by ignorance, under the title of *fungus*. The period of the inſulated or exfoliated ſtate of a dead portion of bone ſhould be timely aſcertained: then it is that ſurgery may be eminently uſeful; for, ſuch portion will be felt as an extraneous body, and upon its ſpeedy removal the fate of a limb, or even life itſelf, may depend.

When a ball, or any other thing, becomes lodged, it often happens, that the veſſels of the ſurrounding parts, when the ſurpriſe from its introduction is over, ſet about accommodating themſelves to the preſence of the body. The conſequence of their friendly exertion is, a callofity of the immediately-ſurrounding ſurface, graduating to the naturally flexible parts. Thus the ball obtains a bed, that ſhields the more diſtant and tender parts from the effects of its preſſure. Bodies are more likely to remain quiet in cellular and fatty parts than when near muſcle. — A hollow, with ſuch a callous ſtate of the ſides, ariſing from the preſſure of retained matter, is termed *fiſtula*.

Removal of the thing that preſſes, and prevention of future preſſure, are all that are required towards relief.

Inflammation in the callous parts, from adventitious cauſes, during the reſidence of a ball, &c. may produce a train of ſcrious evils, that can be prevent-

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ed or remedied only by the extraction or diſcharge of the body.

Injuries of large nerves, particularly in the extremities, and more eſpecially in the fingers and toes, are moſt likely to occaſion locked jaw: injuries of muſcle may be ranked in the next degree among the cauſes of this dreadful ſymptom.

That ſtate of debility, joined with irritability, produced by warmth of climate, particularly diſpoſes to ſpaſm and convulſion; which ſhould be guarded againſt accordingly.

To obviate theſe evils, the ſyſtem is to be fortified by a generous regimen, bark, &c. while every thing beſides is done that is calculated to allay irritation.

All the parts about the head are highly organized, and thence liable to ſtrong inflammation when injured. Evacuations are, therefore, to be early and copious.

Hurts received in the head, as well as the trunk, are dangerous, alſo, from the proximity of parts important to life.

BURNS from gun-powder are to be regarded in the ſame light as burns from any other cauſe. The *degree* of injury from HEAT, by whatever *medium* applied, is the principal point to be conſidered. —— In every caſe, there is irritation: this may be with or without veſication; and with or without coagulation of the juices, or death of ſome portion. The heat may alſo be ſo intenſe, as at once to decompoſe and criſp up the parts to which it is applied.

In ſlight burns, cold ſpring water and vinegar, or cold water alone, applied by means of linen kept conſtantly moiſt, generally prove good remedies. In burns of greater degree, it may alſo be uſeful during the firſt two or three days; when it ſhould be ſucceeded by fomentation and poultice.

This caſe, alſo, is diſtinguiſhable into two ſtages. All that is appropriate for leſſening irritation is to be done in the firſt period; and the commencement of ſuppuration,

puration, and ſloughing, may be conſidered as the index of the ſecond ſtage, when wine, bark, &c. will probably be neceſſary.

IRRITATION in the higheſt degree, as relative to the irritable ſtate of the body, occaſions ſpeedy death. The nature of the irritant makes little difference. A ſcald, in a ſlight degree, through its extenſiveneſs over the ſenſible ſkin, may quickly cauſe death. The abolition of the vital functions, from this cauſe, from arſenic, corroſive ſublimate, &c. when happening ſoon from mere irritation, is to be accounted for upon the ſame principle.

Wounds, of every deſcription, and injuries from heat, lead to various ſtates that require the niceſt chirurgical regard. The condition of PURULENT SORES, for inſtance, is what calls for conſtant attention. Some obſervations upon that ſubject may not, therefore, be unacceptable.

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The operations of nature are hidden from human ſight, although her agents be ſometimes known by their effects. In the forming and moulding of parts in animals, the arteries and abſorbents are underſtood to be the immediate inſtruments; but this is learned from the works of theſe veſſels, and not from obſervations upon their actions. The organizing proceſs of uniting parts, and ſupplying deficiency, is veiled by a covering of matter. This may be conſidered as a matrix into which arteries, veins, and abſorbents, are extended: its condition is, therefore, a point of important conſideration; for, it expreſſes the diſpoſition of the veſſels that are to organize. Theſe veſſels may be influenced by internal means, circuitouſly applied; and, alſo, more directly, by external applications. To determine with judgement upon the latter, it is neceſſary to have correct general ideas of the various ways in which things, when applied, act upon the

veſſels

veſſels that firſt ſecrete pus, and afterwards ramify into this fluid.

Things applied to purulent ſurfaces are of a nature miſcible with pus, becoming conſtituents of it, as watery, ſpirituous, and ſaline, preparations; or immiſcible with it, not altering its properties, only retaining it, and defending the tender ſurface, as oily and waxen ſubſtances. They may conſiſt of parts, ſome of them miſcible, others immiſcible, with pus; the latter, by warmth and confinement, ſeparating from the former, as in ointments containing metallic and other ſalts. Subtle, oily, and aërial, particles may be diſentangled from ſubſtances in which they were involved when applied, and may either unite with, or penetrate through, the medium of pus, and ſo, or in both ways, act upon the veſſels of the ſurface; as when the eſſential oil of turpentine is evolved from reſinous articles, or fixed air is extricated from fermenting ſubſtances. Alſo, ſome articles act upon ſores in a

manner

manner purely mechanical, as lint, linen, ſilk, ſponge, &c.

From what has been remarked, it will appear, that the pus prepared by the veſſels of the part itſelf is at all times the *immediate* and proper covering and defence of the ſore ſurface; and, conſequently, as there is this medium, that chirurgical dreſſings do not come into contact with the granulated ſurface, otherwiſe than in the manner explained, either by uniting with, or penetrating through, the matter; except at the moment of applying them, after it has been wiped or waſhed away.

It will be alſo plain, that to bring about, and to maintain, a proper ſecretion of pus, are the ſimple objects of ſurgery in the treatment of purulent ſores; becauſe, healing proceeds properly, while the ſecreted matter is prepared in due quality and quantity.

Gentle ſtimulants are often of great utility in keeping up the healing proceſs. The lunar ſtone, *(argentum nitratum,)* applied,

applied, in the lighteſt manner, to the ſurface of the ſore, avoiding the edges, is particularly beneficial. Other ſtimulants will, however, ſometimes prove more uſeful in changing the diſpoſition of the veſſels.

The effect of acids, in correcting the air when abounding with putrid effluvia, particularly in their concentrated ſtate, and elevated in vapour, is well known; but the favourable influence of *vinegar* in SORES is not generally underſtood. The practice, as it has been many years followed at the London-Hoſpital, conſiſts in the application of linen, frequently wetted with a mixture of one part of common vinegar and two parts of freſh ſpring water. The freſhneſs of the water adds much to the efficacy of the remedy: no more, therefore, ſhould be mixed than is required for immediate uſe, as the water ſhould be inſtantly drawn from the well. Diſtilled vinegar, and river or rain water, may, however, prove uſeful

ſubſtitutes.

ſubſtitutes. In the ſummer-ſeaſon, in hot climates, when putreſcency is to be counteracted locally, or in the ſurrounding air; or when a cuticle only is required upon an organized ſurface, this topical mode of treatment will deſerve attention. No perſon of underſtanding, however, would apply even vinegar and water to a ſore without due advice, provided it could be obtained: for as all effects are relative to circumſtances, much judgement is often required in determining upon the ſafety of the moſt ſimple means.

Vegetable applications are frequently preferable to thoſe of an unctuous nature. Some plants afford dreſſings in their foliage entire, as the cabbage, mallow, plantain, &c.; the leaves of others are applicable when bruiſed, as thoſe of hemlock; and many roots, freſh or boiled, pounded, &c. have proved efficacious in mending the condition of a purulent ſurface, as carrot, potatoe, onion, &c.

CONTUSION, from whatever cauſe, differs only in degree. It frequently happens from ſpent balls, fragments of ſhells, and ſplinters. The veſſels of the contuſed part may be merely irritated; may have blood forced, through their open extremities or ruptured ſides, into the cellular ſubſtance; or may be diſorganized, and deſtroyed as living tubes. In each caſe, there muſt be irritation; to allay which, bleeding, purging, and opium, are neceſſary: and, in the view of promoting the abſorption of extravaſated blood, theſe evacuations are principally to be depended upon. The beſt immediate applications are thoſe endued with aſtringency: vinegar, water, and ſpirit, are proper. Afterwards, fomentation, poultice, embrocations, &c. may be neceſſary. Collections of extravaſated blood ſhould not be opened without abſolute neceſſity. The utmoſt exertion ſhould be made to obtain the removal of the fluid by abſorption. A wound, made to diſcharge blood from a

bruiſed part, generally becomes ill-conditioned, and ſometimes proves fatal. When the violence of contuſion is ſuch as to deſtroy parts, the period of their ſeparation is to be looked to with a watchful eye; for, evacuations beyond that time, and in the interval of it, farther than ſymptoms abſolutely demand, would be dangerous. The ſtate of parts fatally contuſed, yet remaining entire, has ſometimes deceived unwary obſervers.

It may be uſeful to add a word of caution reſpecting the uſe of *vulnerary balſam*, *tincture of myrrh*, &c. in ſimple wounds. Not a drop is to be ſuffered to paſs into the wound; for, it would irritate, form a medium of varniſh over the ſurfaces of the divided parts, and fruſtrate the intention of its application. The ſides and lips of the wound are to be accurately cloſed, and retained in that ſtate; when ſome lint, over the line of contact, is to be moiſtened with the reſinous ſolution, and ſuffered to dry and harden. In

this

this manner, the parts will be defended from the air, and kept in a ſtate favourable for healing.

I cannot cloſe this tract without obſerving, with much ſatisfaction, that the attention of late paid to the ſurgeons in the army and navy is founded in juſtice to thoſe perſons, and will conduce greatly to the public benefit; for, however ſome men may be irreſiſtibly impelled to ſtudies by their attachment to the objects of them, it generally happens that knowledge is purſued according to the eſtimation in which it is held by thoſe who have the power of aſſigning rank and reward to its poſſeſſors. *Examinations* are proper teſts of that degree of talent *below* which none ſhould be admitted to ſituations upon which the health, happineſs, and lives, of men depend: but examinations can neither create abilities nor direct their application where moſt required. Proper encouragement will do both: it will ſtimulate pupils to apply to the ſtudy of ſurgery with induſtry,

duſtry, ſpirit, and effect; and, when maſters in the ſcience, it will induce them to employ their ſkill in the comfort and preſervation of thoſe members of the community who are entitled to our firſt and greateſt care.

THE END.