

mentions several cases which did very well. The only complication, which he thinks is really to be dreaded, is death of the tissues from the continuous cold; but he says that this rarely occurs except in severe contusions.

In 1838 NIVET¹ published a paper giving some of the results of this method. He mentions, among other cases, nine compound fractures so treated, of which seven recovered, five of these without any local or general inflammatory symptoms. He mentions various accidents which may occur, of which the following are examples: Pain (this generally soon disappears); paralysis (observed in one case); œdema (combat by bandaging); phlebitis (very rare); inflammation of the parts around the fracture; gangrene (generally only where the parts are much injured); ankylosis or stiffness (where the part is kept for a long time in one position).

About 1834 M. CHARLES MAYOR published his work entitled 'De la Localisation des Bains sur les diverses parties du Corps humain.' I have been unable to obtain this work, and have had to content myself with a work published in 1846 called 'Les Bains sans Baignoires et ramenés à leur belle simplicité.' His wish was to provide a permanent warm bath in imitation of nature, for he says: 'Is it with pledgets of *charpie*, with rags spread with various ointments, with compresses and with bandages, cold and dry, that nature carries out the cure? Nature, wise and simple nature, contents itself with calling to its aid a warm and permanent bath, which furnishes it plentifully with lubricating fluids, thoroughly diffused over the wound, and constantly being renewed.' He points out that this bath keeps up an equable temperature, and that nature uses it after removal of the tonsils, after operations for harelip, after tenotomy, cataract, abdominal section, &c., and it is to supply its place in external wounds that he proposes the use of the permanent warm bath. Mayor described a variety of apparatus for use in different situations. He did not place the whole body in the bath, but merely the diseased or wounded part. His apparatus was so constructed as to permit the renewal of the water without removal of the apparatus. The temperature of the water was about 22°-25° C. The baths

¹ *Gazette médicale de Paris*, 1838.

were employed for several days, till in fact there was no fear of the occurrence of accidents.

The advantages of irrigation were admitted by NÉLATON, and more especially by MALGAIGNE,¹ who thought it best to use it intermittingly, and so introduced 'intermittent irrigation.' Malgaigne considered that the temperature of the water ought to be regulated by the first sensations of the patient, and that as a rule it ought to be tepid, i.e. about 20° C. Malgaigne's term 'intermittent irrigation' applied, however, more to a sort of water dressing than to irrigation proper, the cloths applied to the wound being soaked in water and changed at frequent intervals.

Although at first the use of water was greatly resorted to, it soon began to go out of fashion, chiefly, it was said, on account of the accidents to which it might give rise, and when AMUSSAT² *filis* wrote his elaborate thesis on this subject in 1850, it was but little practised. In this thesis Amussat deals chiefly with the question of the temperature of the water. He and his father, after long investigation of the subject, came to the conclusion that many of the bad effects attributed to the employment of water were due to its being used cold. They found that cold water from 0°-10° C., was a powerful antiphlogistic and sedative, but that it was liable to do harm. Water at 30°-35° C. relieves pain in an inflamed part and promotes suppuration: it however tends to cause congestion. Water at 18°-25° C. has all the advantages of cold water without its disadvantages: it abstracts heat, but does not cause congestion. They recommend the use of soft water and water containing few salts. Amussat considers that immersion is the most effectual mode of applying water; next to that comes irrigation, and, lastly, a form of water dressing which he describes in detail.

Looking on irrigation and the water bath simply as a means of abstracting heat, ESMARCH,³ in 1860, writes very strongly in favour of cold, and he recommends iced water and even ice itself. He mentions several cases in support of his views.

¹ *De l'irrigation dans les maladies chirurgicales*. Thèse de concours, Paris, 1842.

² *De l'emploi de l'eau en chirurgie*, 1850.

³ *Archiv für klin. Chirurgie*, 1860.

In 1872 ISAMBERT¹ also writes in favour of cold irrigation, but as there is nothing new in his work, I need not refer further to it.

While this discussion as to the temperature of the water was being carried on, others were using the water bath with the view of excluding the air and avoiding putrefaction. I refer especially to the attempts of STROMEYER, LANGENBECK and VALETTE.

In spite of the writings of Mayor and Amussat, the permanent water bath made but little progress till it was taken up by LANGENBECK. Since 1839 Langenbeck had made several attempts to exclude air from wounds. These attempts resembled those of Jules Guérin and others, previously mentioned, but they were not successful in Langenbeck's hands, owing to the confinement of the discharges. Accordingly, during the Schleswig-Holstein war in 1849, Langenbeck commenced the use of the warm water baths with the view of excluding the air. At the same time also STROMEYER made similar experiments. During the next few years Langenbeck perfected his method, and at length, in September, 1855, he published an elaborate paper on the subject.²

Just before the publication of Langenbeck's paper, PICARD,³ who had been visiting Langenbeck's *clinique*, published an account of his practice and results in the 'Gazette hebdomadaire de Médecine et de Chirurgie.' In this paper he speaks very highly of the method, showing how it relieves pain, how there is but little local inflammation or constitutional disturbance, how the appetite remains good, how granulations form rapidly, so as indeed at times to be exuberant, how there is no odour, and how this method seems to protect the patient against the chance of pyæmia better than any other. In contrast with this, he describes, in a very graphic manner, the course of a wound treated by the ordinary methods—a course common at that time, and indeed, as I have myself seen, by no means uncommon at the present. He says: 'Déjà, grâce au chloroforme, la

¹ *Considérations cliniques sur les bons effets de l'irrigation continue et des applications froides renouvelées dans le traitement des fractures avec plaie.* Thèse, 1872.

² *Deutsche Klinik*, No. 37, 1855.

³ *Gazette hebdomadaire de Médecine et de Chirurgie*, 1855.

douleur disparaît au moment décisif; l'homme vivant est insensible sous le bistouri; ses lamentations ne viennent plus interrompre l'opérateur. Mais après avoir dépassé le seuil de la salle d'opération, dès que la torpeur anesthésique s'est dissipée, le patient, abattu, affaibli, voit s'ouvrir devant lui tout un avenir de souffrances. La douleur, un moment comprimée, se déchaîne avec violence. Plus de repos, plus de sommeil. Les terribles secousses de la fièvre inflammatoire épuisent le malade et compromettent le succès de l'opération. Les tortures quotidiennes du pansement viennent aggraver cet état général. Qui n'a pas eu le cœur serré en entendant les plaintes arrachées par le moindre mouvement de la partie opérée, par le tiraillement des brins de charpie agglutinés, par la pression grossière et inégale du bandage, sans compter l'atmosphère infecte dans laquelle le malade et ses voisins sont condamnés à vivre, les souillures des draps et des couvertures? Enfin, la nature est dérangée dans son travail réparateur; chaque tour de bande change les conditions de la plaie, et le chirurgien ne peut lui-même diriger la guérison.'

Langenbeck placed the wounds in the bath immediately after operation. Where possible, he stitched up the wound, leaving a space at the angle through which discharges passed, and through which the ligatures were brought out. During the first twenty-four hours, the limb was simply suspended in a bath, and was not arranged in one of the apparatuses which are apt to constrict the part and cause bleeding. When the edges could not be brought together, *charpie* and a bandage were applied for the first twenty-four hours to prevent bleeding.

The permanent bath was continued till granulation was complete, and till epidermic formation had commenced. The limb and granulations were apt to become œdematous, but this subsided in a few hours after the removal of the part from the bath. The apparatus was emptied night and morning, and the walls of the vessel carefully sponged with water containing chlorinated soda or chloride of lime. When the stump had been closed at first, the wound was daily injected along the course of the ligatures. The temperature of the water was at first 10°–12° C., but it was raised, as the patient could bear it, to 31°–37° C. The skin of the stump had a thick

layer of grease over it, to prevent the action of the water on the epidermis. Where the whole body had to be immersed, the immersion was continued for a half to one hour daily in water at the temperature of 34° C. Water dressing was employed towards the end of the case.

Langenbeck gives the following as the advantages of the permanent water bath:—

1. It diminishes pain in the wound, and also does away with all painful dressings.
2. The intensity of the fever is less.
3. Stagnation and decomposition of discharges are completely prevented.

He says that in wounds so treated, union by first intention is rare, though not unknown.

Among the cases treated in this way he had had, during a period of five or six years, no instance of pyæmia, although, as he says, some of the cases were very well suited for its occurrence, and although pyæmia was prevalent at the same time in other wards and even in cases in the same ward. He says: 'Cooling of the wound, retention and putrefaction of the discharge, and miasmatic influences (hospital air) are the causes of pyæmia. These noxious agents can be completely excluded by the careful employment of a water bath.' He also believes in the spontaneous occurrence of pyæmia, through constitutional and blood defects, and he does not think that these rare cases would be prevented. Then, also, decomposition of the discharges in a complicated wound is quite possible, even in a water bath, and might lead to pyæmia. He mentions several (7) cases to show the good results. It is interesting to note that one of these—the only fatal case—was one in which, during the removal of a tumour, the knee-joint was opened. Violent inflammation and suppuration of the joint followed and the patient died on the twenty-first day.

Langenbeck's paper was followed a month later by one by Dr. FOCK.¹ He confirmed Langenbeck's good results, comparing together cases of Pirogoff's amputations treated by the warm bath, with others treated by the ordinary methods, much to the advantage of the former. He mentions also that Dr.

¹ *Deutsche Klinik*, Oct. 1855.

WAGNER of Dantzic, who had adopted it, reported that formerly pyæmia was very prevalent in that hospital, but that since the introduction of the warm water bath it had almost entirely disappeared.

In a paper in 1856, Picard¹ mentions that GOSSELIN and LAUGIER had adopted this method, and Fock also refers to ULRICH.

In October 1856, ZEIS of Dresden published a note entitled 'Beitrag zur Würdigung des permanenten warmen Wasserbades,'² in which he advocates the use of a still higher temperature than that recommended by Langenbeck. Zeis finds that a permanent bath below the body temperature is seldom endured by the patient. The best temperature is 37°–42° C. For amputations 35°–37° C. may be sufficient.

It is unnecessary for me to pursue the history of Langenbeck's method further. It is the one generally adopted where immersion is employed, and for some time it was very extensively used in Germany. It has of late gone out of use, not because its results are not good, but because it is difficult and inconvenient of application, and because it can now be replaced by more effectual and simpler methods.

Before leaving this subject, however, I must do justice to a method in which the antiseptic element was more fully recognised, and in some respects better carried out, but which has, very strangely, not attained any prominence, probably because the name of its author was eclipsed by the better known name of Langenbeck. I refer to the method proposed, and, while he had opportunity, carried out by VALETTE of Lyons.³

Valette's view was the following: 'The safety of subcutaneous wounds sufficiently demonstrates that the presence of the air in the wounds is the primary cause of their bad course.' 'How does the air act? This is a delicate question, but the following is the explanation which appears to me to be the fairest. As soon as the operation is finished the blood and the liquids which collect on the surface of the wound, decompose under the influence of the contact of the air. Sulphuretted hydrogen

¹ *Gazette hebdomadaire*, 1856.

² *Deutsche Klinik*, October, 1856.

³ *Sur une nouvelle méthode de pansement des grandes plaies (méthode anéoplastique)*, *Gazette hebdomadaire*, 1856.

and putrid gases, if you will pardon this expression, are formed and absorbed in part, and exercise a deleterious influence on the body. In a word, there is a true poisoning of the patient, which the constitution often withstands, though not always, especially when the patient is placed in unfavourable hygienic conditions, as is the case in the wards of our hospitals. In these cases the phenomena of cicatrisation do not proceed in a favourable manner, suppurative phlebitis occurs, and pus passes into the circulation; purulent absorption is an accomplished fact, and death is, one may say, an almost inevitable consequence.

To avoid these dangers Valette immersed the wounded part in baths containing water impregnated with tincture of benzine, creosote, alcohol, or perchloride of iron. The last gave the best results. There was no putrefaction of this fluid, and he seems to have had great success. He was especially struck with the absence of traumatic fever.

PUPIER,¹ who wrote his thesis in 1855 on Valette's method, mentions a number of cases which did well, and states that, in order to prevent the water from getting too warm, it was in one case changed as often as thrice daily.

Valette had only a limited opportunity for carrying out his experiments, for after a short time he was placed in charge of a children's ward, where he could no longer practise this method.

D'un traitement consécutif spécial des amputations. Thèse, 1855.

CHAPTER XVI.

HISTORY OF ANTISEPTIC SURGERY—(concluded).

Use of antiseptics: Alcohol—older writers—Nélaton—Hutchinson: Glycerine—Demarquay: Chlorine: Chloride of zinc: Iodine: Iodoform: Chlorate of Potash: Perchloride of iron, &c.: Coal tar—Corne and Demeaux—Report of the commission: Coal tar saponiné—Lemaire—his views on putrefaction: Carbolic acid—Lemaire—Lemaire's position in regard to aseptic surgery—Lister: Further phases in the history of this subject: Objections to Mr. Lister's claim as originator of the aseptic method—Simpson—Neudörfer. Modifications of the method. Substitutes for carbolic acid. Objections to the aseptic method.

THE last point to which we have to refer is the use of *antiseptics*. As we have already seen, various antiseptics have been in use for many centuries as applications to wounds, and some surgeons indeed have ascribed the good results, derived from their use, in the main to their anti-putrescent properties. In spite, however, of the attempts of surgeons at different times to draw attention to these properties, it was not till the publication of Corne and Demeaux's method in 1859 that general interest in the subject was aroused.

Among the substances formerly employed, *alcohol* was probably the one in most extensive use, and after the subject of antiseptics came to the front, it was freely employed in some quarters. As I have just said, alcohol was formerly used in great quantities, but then it was generally combined with other substances, though it probably was really the active basis of the compounds so prepared. Thus the balsam of Fioraventi—a celebrated application to wounds—consisted of turpentine, myrrh, aloes, a large quantity of alcohol, and several unimportant substances. Many of the various lotions which have been most popular at different times had a similar constitution.