

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.

BATAILLÉ¹ published a little pamphlet in 1859 advocating the use of alcohol, but it was most extensively adopted by NÉLATON in 1863, and also by LE FORT.

CHEDEVERGNE² in 1864 published a detailed account of Nélaton's practice with the results which he had obtained. Nélaton's method was to soak *charpie* with camphorated alcohol, and apply it over the wounds in thick layers. These were either kept wet by frequent arrosion, or were covered with an overlapping layer of impermeable tissue, or in some cases the dressing was changed twice daily. Patients treated in this way remain in good health, the edges of the wounds adhere, no granulations are formed, but the wound becomes covered with a layer of lymph under which cicatrisation rapidly occurs. This is the rule, though not an absolutely constant one. In open wounds the granulations can scarcely be seen. There is an abundance of coagulable lymph, almost no appreciable suppuration, and no bad smell. In some cases the *charpie* becomes embedded in the coagulated albumen, and the whole dries up and forms a crust.

Chedevergne says that, for more than a year, operation wounds, and injuries, had been treated with camphorated alcohol, or with pure spirits of wine, and that during that time pyæmia and other infective diseases had been almost entirely absent. Of forty-eight patients who had undergone severe operations, only three died; one of tuberculosis, one of hypostatic pneumonia, and one of pyæmia.

ROCHARD³ gives later statistics, in which he shows that there were only two cases of pyæmia, and five of erysipelas. Good success in the Hôpital des Cliniques!

On a previous page (p. 269) I have referred to Mr. HUTCHINSON'S method of using alcohol. He mixes it with acetate of lead somewhat after the manner of Astley Cooper.

Glycerine was used pretty extensively in England after 1840, but was introduced in the treatment of wounds mainly by DEMARQUAY in 1855.⁴ He first employed it in cases of hos-

¹ *De l'alcool et des composés alcooliques en Chirurgie.* Par MM. Bataillé et Juillet, 1859.

² *Bulletin général de Thérapeutique*, vol. lxvii. 1864.

³ *Loc. cit.*

⁴ *Gazette des Hôpitaux*, October, 1855.

pital gangrene, and he found that they rapidly began to improve under its use. He then extended the treatment to ordinary wounds. He claimed all sorts of advantages for it. In 1859, more especially, he stated that it was a specific against erysipelas, pyæmia, hospital gangrene, &c. He thought that it was the best antiseptic substance, and indeed a universal panacea. Since that time it has, however, been extensively tried and found wanting, and has, as Rochard says, for a long time been justly relegated to the modest place in therapeutics which nature had assigned to it.

Chlorine and its compounds have been used as disinfectants ever since its discovery in 1774. GUYTON, in 1795, recommended its use in hospitals by fumigation, in order to destroy miasms. The Liquor de Labarague, which attained considerable notoriety as a disinfectant, consisted mainly of chlorinated soda. In more recent times the chlorine compounds, more especially chlorinated soda and chloride of lime, have been employed in the treatment of wounds, the wounds being washed or syringed out with the solution, and dressings applied which were frequently moistened with the same. HERVIEUX applied a sponge soaked in the solution to the wound, and this, according to him, not only disinfected the discharge, but also absorbed it. M. GUERSANT also used it largely.

CHALVET¹ recommends the introduction of chloride of lime into the superficial layer of the *charpie*. Chlorine is given off from this, and prevents the decomposition of the discharges.

We have already mentioned *chloride of zinc*, which, as we have seen, was extensively employed as a caustic by CANQUOIN and GENSOUL. BONNET also used it, and remarked on the absence of putridity in the wounds made by it. In more recent years CAMPBELL DE MORGAN has again used it as a caustic, and also made the same remark as to its antiputrescent powers. It thus came to be employed as a lotion in the treatment of wounds, but it has never become extensively used. The chief use to which it is put nowadays is by Mr. LISTER in disinfecting foul ulcers or sinuses (see pp. 65 and 116).

¹ *Des désinfectants et de leur application à la Thérapeutique et à l'Hygiène.* Mémoire de l'Académie impériale de Médecine, vol. xxvi. 1863.

VELPEAU in 1859 stated that *Iodine* had been in use as a topical application for over thirty years. On the contrary, DUROY asserted that it was only as a consequence of a communication made by him in 1854 that iodine was first employed in wounds. Iodine has at times been used in the practice of various surgeons. Thus Mr. Spence of Edinburgh at one time painted the surface of stumps with iodine, and thought that he got good results from it; however, he soon took to painting stumps with other things, and the iodine fell into disuse.

The only preparation of iodine which is now employed in the treatment of wounds is *Iodoform*, which is of great use in chancres or foul ulcers. I have already referred to the method in which it is applied in the latter cases (pp. 65 and 94).

Various metallic salts have been from time to time introduced, such as *Chlorate of Potash* by MILTON. This acts very well in ulcers in the mouth, but is not of any very great value.

Perchloride of iron was employed as a disinfectant by DELEAU, and I have already referred to the use which VALETTE made of it (p. 346).

Nitrate of lead, *subnitrate of bismuth* and other powders have also been spoken of at various times.

During the middle of the present century there had been constant efforts made in various directions to diminish the great mortality in French, more especially in Parisian, hospitals by means of some method of wound treatment. We have seen how at first it was chiefly the action of the air on the wound which was guarded against, but in 1859 it had come to be fully recognised that the chief thing which was required was to prevent decomposition of the discharges. It is therefore not a matter of surprise that when Corne and Demeaux in that year brought forward a powder which they believed to be capable of attaining this object, attention was at once directed to the subject, and not only did debates occur in the scientific societies, but experiments were also made in the various hospitals with this and other antiseptic substances.

Already in 1815 the antiseptic and disinfectant properties of *coal tar* had been recognised by CHAUMETTE, and GUIBOUIT (1833) and SIRET (1837) also wrote on the subject. In 1846

BAYARD introduced an excellent disinfectant, of which the chief ingredient was coal tar.

In 1858, M. CORNE took out a patent for a powder which he had for some time employed as a disinfectant, and in the same year DEMEAUX¹ used this powder in the treatment of wounds. The powder employed by Corne and Demeaux² had the following composition: of ordinary plaster of commerce in very fine powder, 100 parts; of coal tar (obtained from distillation of coal in the manufacture of gas), 1 to 3 parts. These substances were readily mixed together in a mortar, and then olive oil was added till they acquired the consistence of paste. This paste was applied to wounds, more especially to foul wounds, and it was found that it disinfected (deodorised?) the discharges at once, and that it also absorbed them. They stated that, 'the action of this disinfectant substance seems to arrest the work of decomposition; it keeps away the flies, and prevents with certainty the production of worms.' Their experiments were made partly in private practice, and partly in Velpeau's wards. VELPEAU observed that in the cases treated in this way suppuration was also diminished.

In the discussion which ensued at the following meetings of the Academy, various opinions were expressed as to the use of antiseptics in general, and as to the action of this particular powder.³ M. CHEVREUL found that the coal tar powder did not destroy the odour, but rather cloaked it, while, on the other hand, hypochlorite of lime in large quantities made it disappear. He thought however that the coal tar powder would act in preventing putrefaction. M. BUSSY called attention to the fact that other disinfectants were in constant use, and were also employed to prevent putrefaction. Such were carbon, chloride of lime, soda or potash, creosote, &c. M. RENAULT stated that as long ago as 1840 he had published a memoir on disinfection of wounds; for at that time he had come to the conclusion that the putrefaction of blood and discharges, and the contact of these putrid materials with the wound, were the cause of the bad after-consequences. He had found that hypochlorite of lime was the best, though in some cases the

¹ *Union médicale*, 1860. ² *Bulletin de l'Académie de Médecine*, 1859.

³ *Ibid.*; see also *Gazette médicale de Paris*, 1860.

disengaged chlorine irritated the lungs. Hence he welcomed the coal tar powder, but he stated that vegetable tar acted as well and had a less disagreeable odour. CALVERT had previously shown that carbolic acid, which was present in coal tar, was a powerful disinfectant, and, at a later meeting of the Academy, he stated that it had been used in Manchester in 1857, in the preservation of dead bodies, with success. DUMAS had stated, at a previous meeting, that carbolic acid was present in coal tar in small quantities and that the least trace of carbolate of soda was sufficient to preserve animal matters.

After the reading of Corne and Demeaux' paper and the subsequent discussion in the Academy, a commission was appointed by the Academy to enquire into the matter. This commission consisted of CHEVREUL, J. CLOQUET and VELPEAU. As the result of their investigations, they concluded that this powder was most useful for disinfecting substances, but that it was not a convenient application to wounds, that its odour was disagreeable, that it had often to be renewed and that it soiled the linen. LEMAIRE also adds that it solidifies and prevents the escape of pus.

The commission tried various other substances which had been mentioned, such as glycerine, sugar, chlorate of potash, &c., but found that they were not much better than ordinary cerates. Tincture of iodine was found to act fairly well, but to cause too much pain; chlorine and the hypochlorites were good. Sub-nitrate of bismuth or perchloride of iron used in the form of an ointment (8 grains of the liquor to 30 grains of lard), were excellent applications.

Corne and Demeaux' powder soon disappeared from the list of remedies, but nevertheless attention was attracted by it to the subject of antiseptic applications to wounds.

Among those who spoke at the debates was LE BŒUF, who in 1850 had found that substances insoluble in water, but soluble in alcohol, could be made into an emulsion by the addition of saponine. Such emulsions were very fine and very stable. Le Bœuf proposed that coal tar should be emulsified by the aid of this tincture of saponine.

JULES LEMAIRE at once took advantage of Le Bœuf's suggestion, and in 1860 he published a paper on 'Coal tar saponine.'

The tincture of saponine, to which reference has just been made, is an alcoholic extract of the bark of *Quillaya saponaria* and contains other substances besides saponine. A tincture of 'coal tar saponiné' was made by mixing together 1 part of coal tar with from 2 to 4 parts of tincture of saponine. With this an emulsion was made by mixing 1 part of the tincture with 4 parts of water. This emulsion retained all the properties of coal tar, and is the substance which was used by Lemaire. Lemaire investigated the activity of its various constituents, and found that it contained *saponine* which acts as an antiseptic; *alcohol*, also an antiseptic; *carbolic acid*, a powerful antiseptic, but apt to cauterise the tissues; *benzine*, which is an irritant; *naphthaline*, which is a sedative, and, in Lemaire's opinion, 'modifies and tempers the action of the other substances.'

Lemaire applied this emulsion very extensively in the treatment of a variety of diseases, and also to putrid wounds and ulcers. The results of its use in the latter cases were—1. Disinfection of the wound; 2. The wound assumes a rosy aspect; 3. The sloughs become detached with greater facility than usual; 4. It only exceptionally causes pain. Lemaire also states that it acts powerfully in reducing the quantity of pus secreted. This emulsion was applied in the same manner as other lotions. The wound was washed with it, and then dressed with charpie soaked in the emulsion. I cannot find any case illustrating its use from the time of operation. There is no sort of system described, and Lemaire seems to have used it merely as a disinfectant and as a good application to wounds. In fact he treated the wound with antiseptics, but not aseptically. Numerous letters from various surgeons are published in Lemaire's book shewing that smell was destroyed at the time of the application; but that in some cases the discharge became foul before a fresh application was made.

His views on the germ theory of putrefaction are of the greatest interest, as he was undoubtedly the first who, recognising that theory, applied it to practice. He says, 'the wound which suppurates, as I hope to demonstrate presently, is a secreting surface, the products of which become altered under

¹ *De coal tar saponiné*, 1860.

the influence of air and give birth to a series of phenomena due to one and the same cause, fermentation.' He believed that pus at the commencement is simply serum of the blood containing fibrin, that fermentation occurs in this from contact with the air and that pus corpuscles correspond in their nature to yeast cells and are the result of this fermentation. Now coal tar saponiné at once arrests this fermentation and consequently this formation of pus cells. I have already referred to Lemaire's experiments on putrefaction and other fermentations (p. 218). He concludes that the two principal properties of coal tar saponiné are disinfection and arrest of fermentations. 'A third important property which seems to me to be the cause of the arrest of the fermentations, is the toxic action which it exercises on vegetables and on the lower animals.' It favours healing by disinfecting the wounds and arresting the fermentation of pus. He concludes that the germ theory of fermentations is true, and that coal tar arrests and prevents fermentation by its toxic effect on the lower organisms which cause them. He says again: 'These facts make me think, that it is on account of its toxic properties on vegetables and on the lower animals that coal tar can prevent or arrest fermentations. The opinion of Schwann and of several other physiologists, a view which in the present day has received great support from M. Pasteur, appears to me to be true.' . . . 'As the ferments appear to be the infusoria and the microscopic vegetable organisms which exist in abundance in the atmosphere, and as the "coal tar saponiné" destroys them, let not physicians forget this precious property. *Perhaps it may permit them to make important discoveries, and to render a great service to humanity.*'¹

While Lemaire was using this coal tar saponiné he was also experimenting with carbolic acid. He found that carbolic acid could form a 5 per cent. solution in water, and could also be dissolved in oil and alcohol. He found too that it was much more powerful than coal tar, but that its volatility and its powerful action on wounds were disadvantages. On the other hand, with carbolic acid he had a solution of known and constant strength, which mixed with the discharge and soaked into the

¹ The italics are mine.

tissues more readily than the emulsion of coal tar. He published a work on the subject in 1863, called 'De l'acide phénique,' and such was the interest excited in France by this work that in 1865 a second edition appeared.

The greater part of his work is taken up in discussing the germ theory, which he advocates, but the experiments, though numerous and laborious, are so crude and imperfect that I have not been able to make any use of them, though I had much wished to do so, if only for their historical interest.

In applying carbolic acid to medicine and surgery, he seems to have been guided by no principle or rule, but simply to have applied it empirically. Thus the following is a list of some of the diseases in which he used it: acne, anthrax, asthma, cholera, dysentery, ecthyma, eczema, erysipelas, intermittent fever, typhoid fever, herpes, impetigo, lichen, purulent ophthalmia, pityriasis, phthisis, prurigo, sycosis, cancerous ulcers, tænia, smallpox, &c. In cases where it did good it was supposed to have killed germs. He used it also in ulcers in the same way as the emulsion of coal tar, and where tortuous canals existed, the lotion of the strength of .2 to 1 p. c. was injected. He says very little about recent wounds; indeed the following is about the only passage I can find. 'Pour mettre les solutions de continuité des tissus à l'abri de la fermentation il suffit de les couvrir dès le début avec des compresses, constamment imbibées d'eau phéniquée. Deux millièmes de l'acide phénique suffisait dans ce liquide pour obtenir ce résultat.' How very imperfect such a method would be, experience and experiment have since amply shown. He only mentions having treated one case of compound fracture, a fracture of the fingers, in which he used the emulsion of coal tar.

Here there is nothing which can be called a method. Lemaire realized what the causes of putrefaction were, but he made no attempt to exclude them, nor indeed did he make any systematic attempts to eradicate them after they had entered.

In 1865 DÉCLAT published a work on carbolic acid in which he claimed priority over Lemaire. This work contains no observations of any value, and his claim of priority is absolutely

without foundation, for Lemaire began his work before Déclat, and Déclat was well acquainted with Lemaire's work before publishing.

We must in a few words enquire what is Lemaire's exact position in reference to antiseptic surgery? how much does the present advance of antiseptic surgery owe to him? It is a question which for a time has been much debated and variously answered.

In the first place we find, as I have already stated, that Lemaire recognised the true basis of antiseptic surgery, the germ theory of fermentation, and also that he was the first to use carbolic acid extensively in the treatment of wounds. But we do not find any method of how best to add the antiseptics to the discharge or how best to exclude organisms altogether. All that we find is that certain results—absence of smell—were attained, and the *explanation* was that the carbolic acid had destroyed the causes of fermentation. Then, also, look at the aimless way in which he applied carbolic acid to all sorts of diseases. There was no definite plan, no clear purpose, in these attempts.

On the other hand, we must remember Lemaire's opportunities. He had no hospital appointment as surgeon; no opportunity, therefore, for seeing a sufficient amount of surgical practice to realise the necessity for systematic action. Would he have elaborated any aseptic, or even thorough antiseptic method had such opportunities been given him? I cannot say, but I doubt it, for his experiments shew the same want of purpose and imperfection in inference, while his views on pus cells, and many other points, show an imperfect appreciation of the elementary facts of physiology and pathology.

I am not, however, concerned with what he *might have been*, but with what he *was*; for indeed, as Carlyle well remarks, 'it comes that these same *would-have-beens* are mostly a vanity, and the world's history could never in the least be what it would, or might, or should, by any manner of potentiality, but simply and altogether what it *is*.' Lemaire *was* the first to use carbolic acid, and *was* the first to realise the truth of the germ theory as applied to wounds. *He was an advanced treator of wounds with antiseptics, nothing more.*

The use of carbolic acid in the treatment of wounds was for some time tried extensively on the continent, and in England it was also employed by one or two surgeons (Wood, Spence); but, applied in the way recommended by Lemaire, it failed to give satisfactory results and soon began to drop out of use. Indeed, as early as 1867, Dr. Hingston, who had been travelling on the continent, stated, at the Dublin Meeting of the British Medical Association, that 'he had found that the use of carbolic acid in surgery was now being discontinued in places where it was formerly in vogue.'

The result of these centuries of work on the subject of wound treatment may be summed up as follows. The old views, that wounds could not heal without active intervention on the part of the surgeon, had been thrown aside, and, after many oscillations of surgical opinion, it had at last become generally recognised that nature was the sole agent in the reparation of wounds; it had, however, become apparent to most men that the decomposition of the discharges in wounds was a source of danger to the patient so great as to demand active interference for the purpose of preventing it as far as possible. The various attempts which were made with this aim are most interesting and important, although they were all more or less ineffectual. On the supposition that the gases of the air were the active agents, numerous methods (occlusion, crust formation, substitution of other gases, &c.) had been devised for the purpose of excluding the air, but these had all failed in producing any permanent benefit; it was rendered clear from these researches that the gases of the air were not the injurious elements. Subcutaneous surgery, though based on this erroneous view, had become firmly established, and it was universally recognised that, if an operation could be done subcutaneously, it was to a great extent free from danger; unfortunately, the applicability of this method was very limited. Then, at first with the view of regulating the temperature of the wound, various forms of irrigation and water-baths were introduced. Some of the surgeons, however, who employed them observed that decomposition was less, and that this was due in great measure to the washing away of the discharges. Drainage had also to a certain