LECTURE XXXII.

TREATMENT AND PROPHYLAXIS OF SURGICAL SEPTICÆMIA.

Curative treatment of septicæmia almost nil—Prophylactic treatment very useful—Isolation of the wounded in pure air frequently renewed—Different dressings: uniting, occlusive, infrequent, simple, and repeated—Preference given to the infrequent and occlusive cotton batting dressings.

GENTLEMEN: I have little to say on the subject of the curative treatment of surgical poisonings.

In traumatic fever, as I have told you, it is limited to diluent or tonic drinks, a laxative, a few injections, and a dose of opium at night. But we must not deceive ourselves; these measures have but little effect and are almost unmeaning.

In purulent infection the tincture of aconite has been recommended, and I have often prescribed it in a potion or in the tisane, in the dose of two grammes the first day, three grammes the second, and four grammes the following days[1]

I have also given the sulphate of quinine in moderate doses, say seventy-five centigrammes or a gramme daily, or even in a large dose, as M. Alphonse Guérin advises, say a gramme and a half the first day, and two grammes on the following days, and although our colleague has had some success with this, I have seen it, like the preceding one, fail in most cases.

It is true that I saw one of our patients in May, 1871, with a suppurating gunshot fracture of the right humerus, recover from a purulent infection after having taken for a fortnight the daily dose of two grammes, and even during the last few days of two and a half grammes of sulphate of quinine. But, on the other hand, I saw a wounded man at the Hôpital St. Louis, in 1848, and two at La Pitié, in 1865 and 1866, get well without the help of any medicine.

In short, some fortunate subjects after having shown all the symptoms, especially the repeated chills, of purulent infection, get well. But this has not happened often enough to prove the real efficaciousness of any drug. The few who have recovered after treatment with one or another of them, would probably have done just as well without them.

I do not, however, wish to discourage you, and to advise you to remain inactive spectators of the contest carried on by the organism against the poisons. I advise you to give sulphate of quinine notwithstanding my doubts of its value, to give with it from thirty to sixty grammes (℥i–ij) of brandy daily, pure or mixed, in a potion with from two to four grammes of the extract of cinchona. I wish

[1] This is the French tincture. The dose of the *tinctura aconiti radicis* (U. S. Pharm.) is from 5 to 10 drops gradually increased.

only to warn you that recovery is very rare, that the real curative treatment is yet to be found, and that consequently we must first turn our attention to prophylactic measures.

Well, the theory which I have developed before you has, above all others, the advantage of opening the way to every prophylactic endeavour, and that is why I have adopted it, notwithstanding the hypothetical nature of so much of it.

I have told you, that, according to the unanimous opinion of all contemporary surgeons, air vitiated by crowding is one of the main causes of the poisonings, and especially of purulent infection. You see at once the consequences. When you have a patient whose wound exposes him to septicæmia, and especially when, in all probability, acute suppurative osteo-myelitis may set in, you should put him in a room which is not crowded and in which the air can be changed.

Of late years you have heard small hospitals recommended, small wards, and, so far as possible, the erection of hospitals outside of the large cities. As applied indiscriminately to all patients, these precautions are exaggerated and useless.

Speaking only of patients with surgical affections—those who have no wounds and those whose wounds or ulcers are superficial are not exposed in ordinary hospitals to the diseases we are now considering. It is always well to avoid crowding, to have, for example, about 40 cubic metres of air for each bed, to have means of ventilation, to change the air by opening the windows, to have separate rooms for the delirious and those with erysipelas. On these conditions a hospital may be established in a large city and receive without objection 500 or 600 patients.

But these conditions are not sufficient for those whose wounds expose them to traumatic poisoning, nor are they sufficient for puerperal women whose uterine wounds expose them in the same way.

For such patients, in hospital, large isolated rooms with good ventilation are needed, each to contain only three or four persons. These rooms may, if necessary, be in an ordinary building, but the hygienic conditions are best realized by a tent, large enough for four or six beds, placed in a large open space, such as our Paris Administration has already furnished to the Necker, St. Louis, and Cochin hospitals, and such as I have for several years asked for at La Charité, where the small size of the courtyards and gardens renders the plan difficult of accomplishment. And this leads me to say, in passing, to those of you who will be called some day to advise upon the construction of hospitals, that it is necessary above all things to have open spaces large enough to contain, under conditions of proper aeration, warmed tents or huts for patients whom you know to be threatened with acute putrefaction and all its consequences.

Of course, if the patient is in a private house every effort should be made to give him a large room facing to the east or south, with at least one large window, and, if the season is suitable, an open fire heating sufficiently to allow the windows to be opened occasionally without chilling the room.

If the topographical conditions of the hospital or of the home do

not allow these indications to be properly and permanently met, you must try to do it temporarily at least by carrying the patient from one place to another. At the St. Louis and Lariboisière hospitals in Paris, for example, I have seen patients suffering from serious wounds and amputations placed in tents during the day and brought back to the wards at night. In case there are no courtyards or gardens, the balconies can be made use of in the same way, as they are large enough to hold several beds, and allow the patients to be brought into the open air, when the weather is suitable, without the inconveniences incidental to carrying them. Balconies, however, are lacking in most of our hospitals. They are an improvement which you may find it well to remember.

In private practice, if there is no courtyard or garden to which the patient can be taken during the day, if moreover the season is not suitable, or if it is too cold for the windows to be opened long enough to effect a renewal of the air, the patient should at least be moved from one room to another in his bed, as I advise and practise in the treatment of erysipelas.[1] When the change has been made, the windows of the room which the patient has just quitted are left open for three or four hours, and then the fire is lighted and the room warmed before he is brought back.

But if the conditions are such that the patient can be isolated neither permanently nor temporarily, if his room cannot be changed, and if, as is too often the case in our hospitals, he has to remain constantly in a more or less crowded ward, our only resource is to secure the renewal of the air, as far as it is possible, by keeping the windows open whenever the weather permits. When the weather is warm the problem is solved easily enough, but when it is cold it is much more difficult and we have to contend against all sorts of opposition. A draught of fresh air is often disagreeable, the patients, the orderlies, the nurses themselves are slightly incommoded by it, infer that it is dangerous, and hasten to close the window. In this respect La Pitié Hospital was better than the others in which I have served. One of the windows in the male ward was so arranged that it could be left open all day and often part of the night without troubling any one. The nurses and servants were not disobedient, and I obtained very good results, better than I obtained elsewhere, which I mentioned in my paper read before the Medical Congress of 1867.

Apropos of ventilation, you often hear managers and architects praise artificial ventilators, like those which have been constructed at Beaujon and Lariboisière hospitals, into the details of which it would be useless to enter here. The principle of these systems is very good, for its object is to renew the air without chilling the room. But the results obtained in the surgical and lying-in wards of these two hospitals have proved that they are not sufficient to prevent traumatic poisoning. It may be that, well arranged as they are, these ventilators renew the air only very imperfectly. They establish only very

[1] Article Erysipèle in the Dictionnaire de Médecine et de Chirurgie Pratiques, Paris, 1871, tome xiv. p. 1.

narrow and limited currents instead of the broad ones produced by open windows and fireplaces that draw properly. And then these apparatuses rarely work well. They depend upon a fire which has to be fed constantly, and which, either by negligence or lack of fuel or for any other cause, is allowed to go out. Then the ventilation stops. I am far from proscribing ventilators absolutely; but I consider them insufficient for the object which we now seek, and their use, though it may be advantageous for the mass of patients, does not relieve us from the necessity of using for those now under consideration the measures of isolation and aeration which I have mentioned.

Dressings.—Surgeons have always sought, but especially during the last sixty years, for modes of dressing large wounds which would protect their patients from the complications which now occupy us.

The ideas which guided them varied, and were gradually modified by those which were advanced as to the origin of these complications. Not wishing to speak of all kinds of dressings I shall mention only those whose principal aim has been to prevent traumatic fever and purulent infection, and I shall try to show how their mode of action accords with the pathogeny I expounded before you. From this standpoint I shall examine successively: *uniting dressings*, *infrequent dressings*, *dressings by aspiration or pneumatic occlusion*, *occlusive dressings*, *disinfecting dressings*, and finally *daily*, *simple*, *and painless dressings*.

Uniting dressings.—By this name I designate those which keep the edges of the wound near together and, so far as possible, in contact for five or six days by means of strips of diachylon plaster, or of linen dipped in collodion, or of interrupted or quilled sutures. Their object is to obtain what is called *immediate union*, that is, cicatrization of the solution of continuity without suppuration and by prompt transformation into cicatricial tissue of the plastic lymph or blastema which is poured out after the first twenty-four hours on the surface and between the lips of the wound. You see at once how, so far as putrefaction and septicæmia are concerned, this kind of dressing would act. It would prevent suppurative inflammation, and with it the whole train of local symptoms, at the head of which we placed the formation of eschars and the decomposition in contact with the air of all the organic parts deprived of vitality.

Nothing could be better than such a result; but can it be easily obtained? is it often obtained in practice? and, in case of failure, have the measures taken to procure it any disadvantages?

Notice first, gentlemen, that immediate union is impossible in many cases: in those, for example, in which the integuments have suffered a loss of substance; in those in which although there has been no loss of substance the edges are so widely separated that they cannot be brought together; and finally in those of contused and gunshot wounds with such bruising of the edges that mortification and suppuration must take place. We can examine it then with reference only to those cases in which it is possible, and that is mainly those in which amputation has been performed.

As for those, I do not hesitate to tell you that immediate cicatrization is very rarely obtained. I have seen it, and so have other

surgeons, succeed in children, in whom, moreover, the attempt if unsuccessful has not the disadvantages of which I shall presently speak. But I have seen it succeed very rarely in adults, and all my colleagues at Paris have had the same experience. A few years ago I heard it said, and I have also read in Serré's *Traité de la Réunion Immédiate*,[1] that they succeeded more often in the south of France, and especially at Montpellier. But I doubt if this assertion has been justified by a sufficient number of facts, for now I hear the contrary asserted, that attempts to obtain immediate union upon adults have no greater success in the south than in the centre and north of France.

I believe myself then justified in saying that in the immense majority of cases suppuration is not prevented by this mode of treatment, and that in your practice hereafter you should use it only if the experience of your predecessors and yourselves has shown that the locality where you practice is exceptional in this respect, and that in it wounds, when their edges are brought together, generally heal without suppurating.

Understand, too, how difficult it is to obtain completely the result sought for by dressings of this kind. In an amputation wound you have to distinguish two things, the integumental edge and the bottom of the wound. The edges are easily kept in contact by the means of reunion, and have a simple structure which allows prompt agglutination without suppuration. But the bottom, that part composed of muscles, tendons, aponeuroses, and bones, cannot be brought together so exactly.

Even when a flap amputation has been made, there are always irregularities of the surface which do not allow all the points to be brought, and especially to be kept, together; how then can we hope that all these parts differing in vitality will be simultaneously protected from that which always threatens in the first period of exposed wounds, that is, the mortification of some of the tissues over which the knife has passed. However perfect may be the coaptation of the edges, is there not reason to fear that a little air may have been imprisoned at the bottom of this wound, and that the blood and the lymph, when poured out, will be subjected to its decomposing influence? Clinical observation, gentlemen, has shown these objections to be well taken. At the beginning of my surgical career I tried, and saw others try, to get immediate union; this was in consequence of what Prof. Ph. J. Roux[2] had told us of the habitual and even exaggerated use of this practice in the English hospitals, and of the views which John Bell's[3] and Richerand's[4] works had popularized among us; and yet I never saw perfect immediate union without any suppuration: that is, in the very exceptional cases in which I got good results, and in the two children upon whom I had to amputate at the thigh, there was suppuration at the surface of the wound, the edges of which had not united immediately, and a little deep suppuration along the ligatures which reached from the bottom of the wound to the surface. This suppuration, however, ceased as soon as the ligatures came away.

[1] Serre, of Montpellier, Traité de la Réunion Immédiate, Paris, 1837.
[2] Roux, Relation d'un Voyage fait à Londres en 1814, Paris, 1815, p. 117.
[3] John Bell, Traité des Plaies, Paris, 1825.
[4] Richerand, Nosographie et Thérapeutique Chirurgicales, Paris, 1821.

The best that I saw and obtained, then, was not a complete avoidance of suppuration, but its absence from the bottom of the wound, especially about the bone, and with this so limited suppurative inflammation, the absence of the febrile phenomena engendered by acute suppurative osteomyelitis.

This result, rarely obtained as it may be, is so favourable that we should have to continue to employ this mode of dressing if it were not for its disadvantages, which are real and serious when it fails. Immediate union of a part of the edge, or, if you prefer, of the superficial portions of the wound, takes place. But the deep parts remain separated, the effused blood and serosity have prevented permanent contact. Air has been inclosed when the dressing was applied, or enters at those points on the surface where union has failed. In short, the blood and the liquids decompose and stagnate in the wound. Their retention causes a painful distension, increases the intensity of the inflammation, causes it to take on the gangrenous form, and exposes necessarily to absorption of deleterious substances.

For these reasons immediate union, although excellent in principle, is not now practised; and I repeat that you should have recourse to it only for children and small wounds in adults. Do not use it for the large wounds of adults unless you are practising in a country where wounds rarely take on gangrenous and septicæmic inflammation.

Infrequent dressings.—Under this name we class dressings with which, while seeking, if possible, the same end as with the former, we expect to have suppuration, but we try to avoid the consequences of the inflammation which precedes and produces it by protecting it from contact with the air, and by prolonged rest of the limb.

You will find quoted as being the first, or one of the first, to recommend infrequent dressings, a writer of the seventeenth century, Cæsar Magatus, an Italian surgeon who managed to write a very large folio volume upon this subject.[1] This author objected to the practice of repeatedly forcing into the wounds tents of charpie, covered with drugs supposed to favour suppuration, growth of the flesh, and drying of the wound, and which they changed according to the stage reached by the wound. Magatus also insisted upon the following points:—that in a dressing we must avoid: 1st, The contact of the air, because it irritates the wound; 2d, Movements, because they interfere with agglutination; 3d, The removal of the pus, which, according to him, is a topic which favours repair. With this object in view he recommended that dressings should be simple and rarely renewed—every three, four, or five days. You know, and I shall speak of it presently, that we go further than that, for you have seen me leave the first dressing of an amputated limb untouched until the twenty-second day.

[1] Magatus, De rarâ medicatione vulnerum, seu vulneribus rarò tractandis, Venitiis, 1616.

We must suppose that Magatus's practices and precepts remained unknown to the French surgeons, or that they were forgotten, or that if followed they did not give good results; for when Belloste published his work at the end of the seventeenth and beginning of the eighteenth century[1] he again protested against the practice which still existed in his time, of uncovering wounds twice each day; and in a chapter entitled, *Why wounds should be dressed infrequently*, he advised that dressings should be renewed only every two or three days. "Repose," he says, "is necessary for all growths. The nitrous parts of the air alter the natural balm or nutrient juice which is intended to act as a glue to reunite the divided parts."

Afterwards, when the precepts of the English surgeons concerning immediate union had been formulated conformably to Hunter's ideas of adhesive inflammation and suppurative inflammation, all those who adopted this plan of dressing followed the recommendations of Magatus and Belloste, for the first part of the treatment at least, and left the first dressing in place for four days. Then J. D. Larrey[2] called for seven, eight, or nine days, and Josse of Amiens[3] advised that the first dressing should be removed on the tenth day, and the subsequent ones only every two or three days.

Up to this time, you see, they hardly went beyond the tenth day. Maréchal, in the cases of amputation of the forearm reported by Sazie,[4] went twelve days. But at the present time, as I have already told you, M. Alphonse Guérin, taking up again this method which hitherto had not yielded results good enough to attract surgeons very strongly, based his action upon the pathogenic theory that purulent infection is due to absorption by the wound of miasms carried by the air. The conclusion was simple. Wounds must be protected from this contact by more suitable apparatuses, and this protection must be provided especially during the first twenty or twenty-five days—that is, for the period during which septicæmia is most to be feared. Indeed, after its second application, the apparatus should again be left in place for about the same length of time; and thus the infrequent dressing should be continued until the end, or near the end of cicatrization.

M. Alphonse Guérin might have used the apparatuses invented by Jules Guérin and Maisonneuve, of which I shall presently speak; but in the first place he wished to avoid the complications of this special arrangement; and, secondly, he wished to add a certain amount of compression to the proposed occlusion, and he justly sought to use common materials, which the surgeon would readily find everywhere. His idea then was to use cotton batting, and to dress amputated limbs with cotton apparatuses, making elastic compression similar to those used by Burggræve[5] in the treatment of white swelling, so that his

[1] Belloste, Chirurgien d'Hôpital, Paris, 1696; another edition, 1708.
[2] Larrey, Clinique Chirurgicale, tome i.
[3] Josse, Mélanges de Chirurgie, 1835.
[4] Sazie, Mémoire sur la Réunion Immédiate et la levée tardive du premier appareil des plaies qui succèdent aux grandes opérations. (Archives Générales de Médecine, 2d série, tome ii. p. 153.)
[5] Burggræve, Les Appareils Ouatés, Paris, 1859.

infrequent dressing is at the same time a cotton occlusive one. To make it, the author, who published his method in June, 1871, covers the wound and the limb for a long distance above when it is a stump —above and below when it is a wound without amputation—with a layer at least five inches thick of cotton batting. Over this he rolls a band very tightly, pressure through the cotton never being sufficient to arrest the circulation, or even to cause pain. In case of an amputation he carefully carries the turns of the band over the end of the stump so as to entirely cover the wadding applied over the wound. When the wound occupies the thigh or arm he carries the dressing as high as the upper end of the limb, or even upon the trunk; and when the injury is of the leg or forearm the cotton is applied at least as high as the middle of the thigh or arm.

By the application of this apparatus M. Alphonse Guérin[1] expects to accomplish two objects—that of preventing air from reaching the wound by means of the occlusion, which seems as if it ought to be complete, and that of exerting compression along the whole length of the limb. At the same time that it may diminish the inflammatory swelling, and perhaps favourably modify the phlegmasia, this compression undoubtedly interferes with the circulation in the lymphatics and superficial veins to such an extent that transport of septic materials is at least diminished, if not entirely prevented. M. Guérin, as I have already told you, leaves this dressing in place for from twenty to twenty-two days. He modifies it sometimes on the second or third day by adding another band if the first seems to be loose, or if it has become soaked with offensive liquids.

Gentlemen, this kind of dressing is still too recent for us to pass final judgment upon it. I do not wish to speak again of its theoretical basis; we could not admit that absorption of atmospherical miasms was the exclusive cause of surgical poisonings. But what of that? We do admit that the presence of air is objectionable, and that it is well to shut it off from the wound. Does M. Guérin's apparatus accomplish this object, and if so, does that suffice to sensibly diminish the chances of septicæmia?

I believe that it does shut the air out entirely, and I base this belief upon two reasons: it seems to me impossible that the air could penetrate this thick layer of cotton and the band about it, and when it is carefully applied as high up as I said, the cotton is pressed so tightly against the skin that the entrance of air at the upper edge of the dressing seems to me to be equally impossible. Secondly, I was present at the removal of the first dressing from two of M. Guérin's patients, and I have myself removed it on the 21st or 22d day from seven patients whose limbs I had amputated. I was struck in all these cases by the thickness and creamy appearance of the pus, the rosy colour of the wound, and the absence of fetidness. Certainly if the air had penetrated to it the pus would have been altered; it would have become fetid and ammoniacal, and the wound would have

[1] Alphonse Guérin, Discussion sur l'Infection Purulente. (Bull. de l'Acad. de Méd. 1871, tome xxxvi. p. 328.)