On the effects of the antiseptic system of treatment upon the salubrity of a single hospital / by Joseph Lister.

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ON THE EFFECTS OF

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OF TREATMENT

THE SALUBRITY OF A SURGICAL HOSPITAL

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EDINBURGH
EDMONSTON AND DOUGLAS
1870.

Edinburgh: Printed by Thomas Constable,

FOR

EDMONSTON AND DOUGLAS.

LONDON . . . . . HAMILTON, ADAMS, AND CO.

CAMBRIDGE . . . . . MACMILLAN AND CO.

GLASGOW . . . . . JAMES MACLEHOSE.

THE EFFECTS OF THE ANTISEPTIC SYSTEM OF TREATMENT UPON THE SALUBRITY OF A SURGICAL HOSPITAL.

THE antiseptic system of treatment has now been in operation sufficiently long to enable us to form a fair estimate of its influence upon the salubrity of an hospital.

Its effects upon the wards lately under my care in the Glasgow Royal Infirmary were in the highest degree beneficial, converting them from some of the most unhealthy in the kingdom into models of healthiness. The interests of the public demand that this striking change should be made generally known; and in order to do justice to the subject, it is necessary, in the first place, to allude shortly to the position and circumstances of the wards.

Each of the four surgeons of the infirmary had charge of three large wards, two male and one female, besides several small ones for special cases. Of these, the most important were the male accident ward and that for female patients, the former containing the chief operation cases as well as those of injury. The third main ward of each surgeon was devoted to chronic male cases, and was in the old infirmary building; but the other two were in the "New Surgical Hospital," erected nine years ago. This consists of four stories above a basement, each floor containing two large wards communicating with a central staircase, besides several smaller apartments. The wards are spacious and lofty, and in the centre of each are two open fireplaces, in a column which runs straight up to the roof, conveying the chimneys of all the floors, and also collateral ventilating shafts, which are warmed by the chimneys that accompany them, and,

communicating with various apertures in the ceilings, form excellent means of carrying off the vitiated atmosphere, while fresh air is amply supplied by numerous windows at both sides, the beds being placed in the intervals between them, at a considerable distance from each other. Except the serious defect that the water-closets in many cases open directly into the wards, the system of construction seemed all that could be desired.

But to the great disappointment of all concerned, this noble structure proved extremely unhealthy. Pyæmia, erysipelas, and hospital gangrene soon showed themselves, affecting, on the average, most severely those parts of the building nearest to the ground,[1] including my male accident ward, which was one of those on the ground-floor; while my female ward was on the floor immediately above. For several years I had the opportunity of making an observation of considerable, though melancholy, interest—viz., that in my accident ward, when all or nearly all the beds contained patients with open sores, the diseases which result from hospital atmosphere were sure to be present in an aggravated form; whereas, when a large proportion of the cases had no external wound, the evils in question were greatly mitigated or entirely absent. This appeared striking evidence that the emanations from foul discharges, as distinguished from the mere congregation of several human beings in the same apartment, constitute the great source of mischief in a surgical hospital. Hence I came to regard simple fractures, though almost destitute of professional interest to myself and of little value for clinical instruction, as the greatest blessings; because, having no external wound, they diminished the proportion of contaminating cases. At this period I was frequently compelled to oppose the wishes of the managing body, who, anxious to provide hospital accommodation for the increasing population of Glasgow, for which the infirmary was by no means adequate, were disposed to introduce additional beds beyond those contemplated in the original construction. It is, I believe, fairly attributable to the firmness of my resistance in this matter that, though my patients suffered from the evils alluded to in a

[1] Statistics collected by desire of the managers established the fact that the ground-floor wards were, on the average, most liable to pyæmia, whoever might be the surgeon in charge; and that those on the floor immediately above came next in this respect.

way that was sickening and often heart-rending, so as to make me sometimes feel it a questionable privilege to be connected with the institution, yet none of my wards ever assumed the frightful condition which sometimes showed itself in other parts of the building, making it necessary to shut them up entirely for a time. A crisis of this kind occurred rather more than two years ago in the other male accident ward on the ground floor, separated from mine merely by a passage twelve feet broad; where the mortality became so excessive as to lead, not only to closing the ward, but to an investigation into the cause of the evil, which was presumed to be some foul drain. An excavation made with this view disclosed a state of things which seemed to explain sufficiently the unhealthiness that had so long remained a mystery. A few inches below the surface of the ground behind the two lowest male accident wards, with only the basement area, four feet wide, intervening, was found the uppermost tier of a multitude of coffins, which had been placed there at the time of the cholera epidemic of 1849, the corpses having undergone so little change in the interval that the clothes they had on at the time of their hurried burial were plainly distinguishable. The wonder now was, not that these wards upon the ground-floor had been unhealthy, but that they had not been absolutely pestilential. Yet at the very time when this shocking disclosure was being made, I was able to state, in an address which I delivered to the meeting of the British Medical Association in Dublin, that during the previous nine months, in which the antiseptic system had been fairly in operation in my wards, not a single case of pyæmia, erysipelas, or hospital gangrene had occurred in them; and this, be it remembered, not only in the presence of conditions likely to be pernicious, but at a time when the unhealthiness of other parts of the same building was attracting the serious and anxious attention of the managers. Supposing it justifiable to institute an experiment on such a subject, it would be hardly possible to devise one more conclusive.

Having discovered this monstrous evil, the managers at once did all in their power to correct it. The extent of the corrupting mass was so great that it seemed out of the question to attempt its removal; but it was freely treated with carbolic acid and with quicklime, and an additional thickness of earth

was laid over it; and, further, a high wall at right angles with the end of the building, and reaching up to the level of the first floor, so as necessarily to confine the bad air most prejudicially, was pulled down, and an open iron railing was substituted for it.

There can be no doubt that these measures must have proved salutary. But even if it were admitted that they cured completely the particular evil against which they were directed, it would still have to be confessed that the situation of the surgical hospital has been far from satisfactory. Besides having along one of its sides the place of sepulture above alluded to, one end of the building is conterminous with the old Cathedral churchyard, which is of large size and much used, and in which the system of "pit burial" of paupers has hitherto prevailed. I saw one of the pits some time since, having been requested to report upon it by one of the civic authorities, who is also a manager of the infirmary, and who, having accidentally discovered what was going on, at once took steps to prevent for the future the occurrence of anything so disgraceful. The pit, which was standing open for the reception of the next corpse, emitted a horrid stench on the removal of some loose boards from its mouth. Its walls were formed, on three sides, of coffins piled one upon another in four tiers, with the lateral interstices between them filled with human bones, the coffins reaching up to within a few inches of the surface of the ground. This was in a place immediately adjoining the patients' airing ground, and only sixty yards from the windows of the surgical wards. And the pit which I inspected seems to have been only one of many similar receptacles, for *The Lancet* of Sept. 25th contains a statement, copied from one of the Glasgow newspapers, that "the Dean of Guild is said to have computed that five thousand bodies were lying in pits, holding eighty each, in a state of decomposition, around the infirmary."[1] Just beyond the churchyard rises an eminence covered by an extensive necropolis, which, however, from its greater distance, must

[1] I doubt if even my sense of the importance of the subject I am dealing with would have induced me to enter into these disagreeable details, were I not able at the same time to bear my testimony to the zealous manner in which the managers of the Infirmary and the Town Council are exerting themselves to correct the evils referred to. I understand that it is in contemplation to abolish entirely intra-mural interment in Glasgow.

have comparatively little deleterious influence. When I add that what is called the fever hospital,[1] also a long four-storied building, extends at right angles to the new surgical hospital, separated from it by only eight feet, and that the entire infirmary, containing 584 beds, stands upon an area of two acres, and that the institution is almost always full to overflowing,[2] I have said enough to show that the wards at my disposal have been sufficiently trying for any system of surgical treatment. Yet, during the two years and a quarter that elapsed between the Dublin meeting and the time of my leaving Glasgow for Edinburgh, those wards continued in the main as healthy as they had been during the previous nine months. Adding these two periods together, we have three years of immunity from the ordinary evils of surgical hospitals, under circumstances which, but for the antiseptic system, were especially calculated to produce them.[3]

It may be well to mention in detail some facts regarding the comparative frequency, before and after the period referred to, of the three diseases to which surgical wards have hitherto been peculiarly liable—namely, pyæmia, erysipelas, and hospital gangrene.

And first of pyæmia. This fearful disease used to occur principally in two classes of cases—namely, compound fractures and the major amputations. In compound fracture, it was so rife just before the introduction of the antiseptic system that I had one of the sulphites administered internally as a prophylactic, in accordance with Polli's views, to every patient admitted with this kind of injury; though I cannot say that we observed any distinct evidence of advantage from the practice. But since I began to treat compound fractures on the antiseptic system, while no internal treatment has been used, I have not had pyæmia in a single instance, although I have had in

[1] About half the wards of the fever hospital are used for surgical cases.

[2] The rapid increase of Glasgow has rendered the Infirmary, in spite of considerable additions of late years, quite inadequate to the wants of the population; but this evil will shortly be remedied by the construction of a general hospital in connexion with the new College.

[3] The antiseptic system was commenced nearly five years ago, but was for the first two years employed almost exclusively in compound fractures and abscesses, which form but a small proportion of surgical cases; so that the system cannot be said to have been in operation for more than three years with reference to the subject of the present paper.

all thirty-two cases—six in the forearm, five in the arm, eighteen in the leg, and three in the thigh. These cases do not include those in which the injury was so great as to demand immediate amputation. But it must be remarked that many of the limbs saved were so severely injured that I should formerly have removed them without hesitation. I almost forget the kind of considerations which used to determine me to amputate under the old treatment; though I know that experience taught us that it was only in comparatively mild cases that it was justifiable to attempt to save the limb. Now, however, there is scarcely any amount or kind of injury of bones, joints, or soft parts which I regard as inconsistent with conservative treatment, except such destruction of tissue as makes gangrene of the limb inevitable as an immediate consequence.

But I may take this opportunity of observing that the attempt to save a limb which, under ordinary treatment, would be subjected to immediate amputation, ought not to be made lightly, or without a thorough acquaintance with some trustworthy method of carrying out the antiseptic system; by which I mean, not the mere use of an antiseptic, however potent, but *such management of the case as shall effectually prevent the occurrence of putrefaction in the part concerned.* Without this such endeavours are far worse than useless; for by the time that local disturbance and constitutional disorder have made it apparent that the antiseptic means have failed, the patient is so much prostrated by irritation and blood-poisoning, that the operation, if performed, is probably too late; and thus a loose and trifling style of "giving the treatment a trial" swells the death-rate at once of compound fracture and of amputation.

On the other hand, the surgeon will not on this account be justified in contentedly pursuing the old practice of primary amputation; for the antiseptic means which it has been the main labour of the last five years of my life to improve are now so satisfactory,[1] that any one duly impressed with the importance of the subject, and devoting to it the study and practical attention which it demands, will, with little trouble to himself, securely attain the results which he desires.

[1] I hope to bring before the profession the improved antiseptic means above alluded to by publishing from time to time cases illustrative of their employment.

I lately visited my wards in Glasgow, after an absence of some weeks, and saw, amongst other cases, a compound dislocation of the ankle in a man who had fallen about four feet from the platform at a railway station, and lighted on the outer side of the right foot, which had been forced violently inwards, producing a contused and lacerated wound, about four inches long, crossing the external maleolus, and communicating with the articulation. When I saw the patient the wound had been converted into a superficial sore, cicatrizing rapidly; and there had been from first to last no deep-seated suppuration, nor any local or constitutional disturbance. I asked my then house-surgeon, Mr. James Coats, with whom the most critical part of the treatment had rested, whether he could reckon pretty securely upon such results. He replied, "With certainty." I asked the question for the sake of others who were standing by, having little doubt what the answer would be, for when I left him in charge I felt sure that the antiseptic management of the cases would be as satisfactorily conducted as if I were present.

At the same time, it is only right to add, that when he entered upon his office, though convinced of the truth of the theory of the antiseptic treatment, he by no means felt the confidence in carrying it out which he has since acquired; and if an able man like Mr. Coats, imbued with the principles which I have striven to establish, required some practical initiation into the subject before he could be regarded as trustworthy, still more must such be the case with those who, educated in the old system, and long habituated to its practice, have to unlearn cherished ideas and instinctive habits.

But, returning from this digression, I must now speak of pyæmia after the major amputations, before and after the introduction of the antiseptic system.

The hospital records are unfortunately imperfect for one of the three years immediately preceding the antiseptic period. In the other two years, the mortality after amputations in my wards may be gathered from the following tables:—

Before the Antiseptic Period.

1864.

Seat of Amputation.	No. of Amputations.	Recoveries.	Deaths.
Shoulder ..	1	0	1
Arm ...	3	1	2
Forearm ...	3	2	1
Thigh ...	1	1	0
Leg ...	4	3	1
Knee ...	2	1	1
Ankle ...	3	2	1
Totals ...	17	10	7

1866.

Arm ...	2	1	1
Elbow ...	1	0	1
Forearm ...	2	2	0
Thigh ...	4	0	4
Knee ...	6	4	2
Leg ...	1	1	0
Ankle ...	2	1	1
Totals ...	18	9	9

On the other hand, we have—

During the Antiseptic Period.

1867.

Seat of Amputation.	No. of Amputations.	Recoveries.	Deaths.
Arm ...	1	1	0
Forearm ...	2	2	0
Knee ...	2	2	0
Leg ...	1	1	0
Ankle ...	1	1	0
Totals ...	7	7	0

1868.

Shoulder ...	1	1	0
Forearm ...	2	2	0
Thigh ...	1	1	0
Knee ...	8	5	3
Ankle ...	5	5	0
Totals ...	17	14	3

1869.

Shoulder ...	2	2	0
Arm ...	2	2	0
Forearm ...	2	1	1
Thigh ...	1	0	1
Knee ...	3	2	1
Leg ...	3	3	0
Ankle ...	3	3	0
Totals	16 ...	13 ...	3

Comparing the aggregate results, we have—

Before the antiseptic period, 16 deaths in 35 cases; or 1 death in every $2\frac{1}{5}$ cases.

During the antiseptic period, 6 deaths in 40 cases; or 1 death in every $6\frac{2}{3}$ cases.

These numbers are, no doubt, too small for a satisfactory statistical comparison; but, when the details are considered, they are highly valuable with reference to the question we are considering. This is especially the case with amputation in the upper limb, where neither injuries requiring primary amputation, nor the operations, involve, as a general rule, much loss of blood or shock to the system; so that, if death does occur, it is commonly the result of the wound assuming unhealthy characters. It happens that there were 12 amputations altogether in the upper limb in each of the two periods referred to. Of the 12 cases before the antiseptic period, no fewer than 6 died—a frightful mortality certainly. And it is recorded that, of those 6, 4 died of pyæmia, and 1 of hospital gangrene. Also that one of those which recovered had pyæmia; but, though the symptoms were well marked and severe, presented an example, unhappily too rare, of recovery from that disease.

Very different was the result of the corresponding amputations during the antiseptic period. Eleven of the twelve cases recovered; and the one death which did occur was not the result of the operation, but took place in spite of it, from pyæmia, which had resulted from fetid suppuration in a metacarpal bone, and continued after I had removed the hand, in the faint hope that the constitutional mischief might be thrown off when its original source had been taken away. Some of the successful cases, I may add, were by no means favourable subjects for operation: as, for instance, a completely shattered hand in a very aged person; the avulsion by machinery of nearly the entire arm, one of the flaps of the amputation at the shoulder-joint being left contused and lacerated as it had been formed by the injury;[1] and, again, an enormous osteoid cancer of the upper end of the humerus, involving the deltoid muscle, and permitting only the formation of skin flaps, attended with profuse hæmorrhage, in a patient already anæmic from the disease.

[1] This case was treated by my colleague, Dr. Dunlop, during my temporary absence.

In the lower limb, 28 amputations in all were performed during the antiseptic period. Out of these, death took place in 5; but was generally sufficiently accounted for by the severity of the case, as when the thigh was amputated immediately below the hip-joint in a patient greatly exhausted by hæmorrhage from malignant disease; or, to take another example, when primary amputation was performed at the knee on one side, and immediately below it on the other, in a man who had sustained very severe injuries to both legs, and had been transported a considerable distance by railway to Glasgow.

In one case only did pyæmia result from the operation—viz., after amputation at the knee in a young man of weakly constitution, where putrefaction occurred in the stump through mismanagement. Here the symptoms of pyæmia presented themselves during life, and the femoral vein was found loaded with pus on dissection. When putrefaction occurs after such an operation, there is no security against pyæmia, even in private practice; and a single instance of the kind in three years, and that in a feeble subject, is certainly no evidence of any peculiarity in the hospital atmosphere.

In mentioning the fact that putrefaction occurred from mismanagement, I do not wish to be understood as implying that it can always be avoided in stumps. In the present state of surgical practice, this is far from being the case. When sinuses exist in connexion with a diseased joint, putrefaction is present in them at the outset; and even if they are injected with an antiseptic solution before the operation, it can never be certain that the liquid penetrates to every recess of these often complicated passages, or destroys the vitality of the putrefactive organisms lurking, perhaps, in portions of lymph or slough. And if a single such organism remain alive, it will propagate and spread in the wound as soon as the antiseptic applied at the time of the operation has been absorbed into the circulation; and any external antiseptic dressing will, under such circumstances, be of course entirely nugatory. It is, I suspect, for want of bearing this point in mind that disappointment has often been experienced in applying antiseptic treatment to amputations and excisions. The full possible benefits of the system can never be obtained in such cases till it shall be deeply impressed upon the profession and the public that abscesses, more

especially those in connexion with diseased joints, must never either be allowed to break of themselves, or be opened without antiseptic precautions.[1]

I am bound to add that there is another respect in which the antiseptic principle has not yet had justice done to it in the larger amputations in the lower limb. Of all incised wounds, these have proved the most difficult to manage; and putrefaction has repeatedly occurred in my practice, even where no sinuses were present. It was so in the two cases above referred to, of amputation just below the hip-joint for malignant disease, and double primary amputation for injury. Considering the condition of those patients on the day after the operation, I believe both would have recovered had we succeeded in avoiding putrefaction, which, apart altogether from the risk of pyæmia, terribly aggravates formidable cases, like those, by the irritation and prostration which it occasions. Hence we may fairly look for better results in the future from amputation in the lower limb. For I am satisfied that the difficulties of the antiseptic management are not insuperable. I have devoted much attention to this branch of the subject during the last twelve months, and steady progress has been made in it; so that the proportion of stumps in which healing has taken place without any deep-seated suppuration has been markedly increasing, and I anticipate that before long we shall be able to reckon with certainty on the absence of putrefaction in all cases where sinuses are not present.

But to return to the subject of pyæmia. The two cases above alluded to were the only instances of its occurrence in my department during the antiseptic period. One of them requires further notice here. It belonged to a class of injuries in which the benefits of the antiseptic system have been conspicuously

[1] The practice which I have found to answer best in amputations and excisions in parts affected with sinuses is, after injecting the sinuses with a powerful antiseptic, to apply to the cut surface a pretty strong solution of chloride of zinc (say forty grains to an ounce of water), such as was recommended by Mr. Campbell De Morgan, and then employ an external antiseptic dressing, in the hope, though never in the certainty, that putrefaction will be avoided. Chloride of zinc, having the peculiarity of producing a remarkably persistent antiseptic effect upon the cut surface, protects it during the dangerous period preceding granulation, when the recently divided tissues are both sensitive and prone to absorption; so that even if putrefaction does occur, the risk of inflammation and pyæmia is greatly diminished.

apparent—namely, severe contused wounds of the hand or foot, such as are very frequent in a great centre of manufacture like Glasgow. Formerly there were no injuries more unsatisfactory to deal with. The uncertainty of the extent of the damage inflicted by the contusion made it a most perplexing question where amputation should be performed. On the one hand, if too little was removed, sloughing of the flaps ensued, or diffuse suppurative inflammation of the weakened tissues infiltrated with extravasated blood; and, on the other hand, if it was determined to avoid that error, and to amputate through perfectly sound tissues, an extravagantly large portion of the limb was often sacrificed. It is therefore an unspeakable satisfaction to be able to avoid amputation altogether in such cases, merely taking away such portions as may be actually destroyed, and leaving the weakened tissues in the vicinity to recover themselves quietly, instead of perishing under the irritating and poisoning influence of putrefaction; while any dead portions that may remain are absorbed more or less completely, like the extravasated blood, and replaced by tissue of new formation. If the history of all the contused wounds of the hands and feet that have been treated in my wards during the last three years were recorded, including many compound fractures not reckoned as such in our classification and several compound dislocations, it would be enough to convince the most sceptical of the advantages of the antiseptic system.

But the case to which I am now alluding was an exception to the general rule of satisfactory progress. It was a severe injury to the hand from machinery. My then house-surgeon, who had only just entered upon his office, and had not as yet the confidence in the antiseptic system which he soon afterwards acquired, took it for granted that I should amputate the hand, and committed the error of leaving it till my visit on the following day, without adopting efficient antiseptic measures. When I saw the case I decided to try to save the greater part of the hand, and endeavoured to correct the mistake which had been made. Putrefaction, however, ensued, and after some days pyæmia occurred, and continued, as before stated, in spite of amputation of the hand. On dissecting the parts, one of the metacarpal bones was found split up, with putrefactive suppuration developed in its interior. Under such circumstances

pyæmia might occur in a perfectly sound constitution and in the most healthy atmosphere, just as, in Cruveilhier's highly instructive experiment, suppurative phlebitis of the femoral vein and its branches, exactly corresponding to that which is seen in traumatic pyæmia, was induced in a healthy dog by introducing into the vessel a bit of wood which, from its porous nature, could not but originate putrefaction.[1]

Considering, then, the circumstances of the only two cases of pyæmia which have occurred in my department during the three years of the antiseptic period, I am justified in saying that the wards have been completely freed from their former liability to this frightful scourge.

Next of erysipelas, a disease which, though not so fatal as pyæmia, used not unfrequently to occasion death amongst my patients. During the antiseptic period several cases have been admitted into my wards from without, but one only has originated in them. This occurred in a young man with disease of the foot, accompanied by sinuses extending into the leg. I performed amputation at the ankle, but putrefaction continued in the sinuses; and after the lapse of a considerable period erysipelas occurred in connexion with them. He recovered from the complaint, and after a while went to his lodgings for change of air, with the sinuses still unhealed, and subsequently had another attack of erysipelas there, implying that the tendency to it was in his own system rather than in the locality. That such was really the case was afterwards fully demonstrated. The sinuses refusing to heal, and disease recurring in the bone, he was re-admitted under my care, and I performed amputation in the leg above the sinuses. The stump healed without any deep-seated suppuration, presenting a very good example of the result of a modification of Mr. Teale's method of amputation; and I requested him to ascertain, by Mr. Teale's plan of introducing circular pieces of flannel into the socket of the artificial limb, how much of his weight he could conveniently rest upon the end of the stump. As he did not call to report the result on the day arranged, I inquired into the cause, and learned that the stump had been seized with a third attack of erysipelas, although

[1] See Cruveilhier's *Anatomie Pathologique*, livraison xi., where will also be found the records of important experiments, proving how readily liquids introduced into the interior of bones pass into the general circulation.

perfectly cicatrized without sinus or sore of any kind.[1] Thus, as regards erysipelas, our only exception to perfect immunity from the disease during the three years was one that strikingly proves the rule.

It remains to speak of hospital gangrene. This was formerly both frequent and severe amongst my patients. It often grievously marred the most promising results of surgery, and sometimes committed fearful ravages. Thus, I have known a boy admitted with a small superficial wound near the elbow, in which hospital gangrene occurring caused such destruction of tissue, deeply as well as superficially, in spite of the most energetic treatment, that it became necessary to amputate the limb. Now and then it led to a fatal result, as in one of the amputations before referred to. In that case I removed the arm at the shoulder-joint for injury in a boy, and for some time all went on well, till I regarded him as perfectly safe; but hospital gangrene came on in the stump, and, advancing insidiously in all directions, defied my best attempts to check it, and had reached beyond the sternum before the poor fellow sank exhausted from its effects.

The contrast under the antiseptic system has been most striking. For the first nine months, as before mentioned, we had not a single case of the disease. Since that time it has shown itself now and then, but in a mild form, invariably yielding to treatment, never occurring in recent cases, but only in old sores weakened by the influence of surrounding cicatrix. But even this has been very rare, and I do not recollect more than one example of it during the last year. In short, hospital gangrene, like pyæmia and erysipelas, may be said to have been banished by the antiseptic system.

Such being the case, I have insensibly relaxed in different ways my former vigilance regarding the wards. I have allowed cribs for children to be introduced without remonstrance, having practically the effect of increasing the number of beds for adults; and I have, in the pressure of deficient accommodation, often permitted two children to be put in one bed—a thing which I should formerly not have thought of. I used to make a point

[1] This case seems to me to possess considerable interest, as something intermediate—as it were a connecting link—between traumatic and idiopathic erysipelas.

of having both the large fires in each ward kept alight night and day during the heat of summer, for the sake of making the ventilation as perfect as possible. But during the last season the nurses were left to follow their inclination, and keep only one of the fires lighted. I may add that my wards have remained during the three years without the annual cleaning, which used to be thought essential. On my asking the superintendent the reason for the omission, he replied that, as those wards had continued healthy, and there was nothing dirty in their appearance, it had seemed unnecessary to disturb them. Thus the wards have been in various respects subjected to greater trial than usual, and yet have remained, as I may repeat without any exaggeration, models of healthiness.

That such should have been the case under the unfavourable hygienic conditions above referred to seems at first sight very surprising. The immediate vicinity of a burying-ground such as has been described, together with the position of the wards at the base of an hospital of four stories, with the air confined by neighbouring buildings, may seem conditions utterly inconsistent with health in the patients. That these circumstances were very unfavourable is undoubtedly true ; and that they were highly injurious before the antiseptic period seems clearly indicated by our experience. But a little consideration will show that it is not unreasonable to suppose them of secondary importance—as aggravators of the evil, rather than the essential causes of it. The corpses in the places of sepulture beside the infirmary were for the most part covered by at least some inches of earth, which has a most powerful effect in checking the evolution of noxious effluvia ; and even the foul gases from the open pits were perpetually diluted by the air with which they mingled, so that but a small proportion of them would enter the wards ; and accordingly, when the patients were cleared out for the purpose of the annual cleaning, there was nothing in the wards to offend the nose. But the emanations from sores are poured directly into the confined atmosphere in which the patients are ; and any one familiar with the faint sickly smell commonly perceptible in surgical wards under ordinary treatment, and still more with the stench which prevails at the time of the daily dressing, will readily understand that putrid exhalations from the patients may be a source of mischief, compared

with which the other circumstances alluded to may be of comparatively trifling consequence.

With the object of getting rid of this great evil as much as possible, I have used antiseptic means, not only where they are of essential importance for the treatment of the individual case concerned, as in recent wounds and abscesses, but also in superficial sores. For though granulating surfaces will commonly heal well enough under a putrid dressing (for such the cleanly water dressing becomes within a few hours of its application), every case so treated furnishes its quota to the vitiation of the general atmosphere of the ward. Hence, for the sake of the inmates generally, it is obviously desirable that healing sores should be dressed with some application which, while permitting or, if possible, favouring cicatrization, should prevent odour. For this purpose some dressing, unstimulating, but at the same time persistent in antiseptic action, is requisite,—a combination which I have sought in various different forms to obtain, and, of late more especially, with very satisfactory results, so that while the healing of superficial sores proceeded with greater rapidity than under water dressing, all my sixty patients might sometimes be dressed without the odour of putrefaction being perceptible in one of them.

The result of this great change has been such as to demonstrate conclusively that the exhalations from foul discharges are the essential source of the insalubrity of surgical wards; and that when this is effectually suppressed, other conditions, which we are accustomed to regard as most pernicious, become powerless to produce serious evil.

It is obvious that the facts recorded in this paper are of extreme importance with reference to the vexed question of hospital construction. With the view of assimilating the atmospheric condition of our large hospitals to that of a private dwelling, it has been lately proposed to do away with them altogether in their present form, and to substitute for them congeries of cast-iron cottages, capable of being occasionally taken down, cleansed, and reconstructed,—a plan which, besides involving enormous expense, would interfere most seriously with efficient supervision of the patients, and with the teaching of students at the bedside. But from what has been related above, it is plain that no material alteration of the existing system will

be required. We have seen that a degree of salubrity equal to that of the best private houses has been attained in peculiarly unhealthy wards of a very large hospital, by simply enforcing strict attention to the antiseptic principle. And, considering the circumstances of those wards, it seems hardly too much to expect that the same beneficent change which passed over them will take place in all surgical hospitals, when the principle shall be similarly recognised and acted on by the profession generally. The antiseptic system is continually attracting more and more attention in various parts of the world; and, whether in the form which it has now reached, or in some other and more perfect shape, its universal adoption can be only a question of time. The noble institutions of which our country is justly proud, admirably adapted alike for the treatment of the sick and the instruction of the student, will then be cleared of the only blot that now attaches to them,—the malignant influence of impure atmosphere.

EDINBURGH, *December* 1869.

EDINBURGH: T. CONSTABLE,
PRINTER TO THE QUEEN, AND TO THE UNIVERSITY.