

THE USE OF GLOVES IN ABDOMINAL SURGERY.¹

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BEFORE the era of modern clean surgery, septic infection was exceedingly common. It was probably the rule and not the exception for this complication to seriously increase the mortality and more particularly the morbidity of all surgical

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procedures. Changes in technique with cleaner methods greatly improved the prevailing results, yet much was desired in that direction. Antiseptic surgery still further advanced the science, but could not be carried out to the desired extent, and aseptic work with a faulty technique was resorted to as a substitute. This, too, proved unsuccessful, and it was found that a combination of the two methods was nearer the ideal plan. Septic infection during surgical operations may come from some focus in the patient, but is far more frequently introduced from without, the hands of the operator or assistants, the dressings, and other means acting as vehicles. Such infection does not in all cases cause death, and the mortality of it in abdominal surgery is perhaps not so high as many might believe. However, it is not uncommon to have this condition make its appearance shortly after operations, and its annoyance to the surgeon is of no small moment, inasmuch as what may at first have practically the appearance of innocence sometimes encroaches so insidiously or so rapidly on the vitality of the patient as to produce a fatal *dénouement*.

This condition has so constantly been present that the surgeon who is so perfectly satisfied with his technique that he does not strive to improve it is considered dangerous. It has been found necessary to put the field of operation into a condition of asepsis to the nearest possible degree and to allow nothing to come in contact with such field that is not in the same condition.

All have been striving to substitute absolute for relative sterility in this work, which accounts for the many little differences in the details of technique of the best surgeons. The dressings, instruments, suture materials, etc., can be absolutely freed from all living micro-organisms by various plans of sterilization, and this negative condition can be maintained almost at pleasure. The air of the operating room is by no means free of pathogenic organisms, though this has probably been slightly exaggerated. Nevertheless the air of the operating room should not be disturbed unnecessarily while instruments, tables, and other paraphernalia of the surgeon are uncovered. In this connection it may be well to emphasize the advisability of surgeons and immediate assistants wearing hair and beard coverings, and the assisting nurses a complete hair covering instead of a small exhibition cap perched upon the top of a heavy suit of hair with its greediness in accumulation of dust and microbes and its equal generosity in parting with them

about the patient. It is absolutely harmful and very common for surgeons to talk freely over an open wound and for them and their chief assistants to breathe directly into it an effluvium that would nauseate onlookers at a short distance. The face mask is probably a step in advance. In the technique of abdominal surgery we have left practically but two points to consider—the preparation of the field of operation and of the hands of the operator and assistants.

Of the former we will mention only the necessity of sterilizing deeply into the sweat glands and deeper skin layers with as little traumatism as possible. The part of especial moment in this paper is the necessity of having as clean hands as possible and of absolutely insuring the patient against infection from the hands. These bring abdominal surgery almost absolutely sure from infection from without. McBurney¹⁹ says: "My conclusion is that the real source of infection of a wound deliberately made by a careful surgeon who uses perfect materials and handles them perfectly is to be sought either in the skin of the patient or in the hands of those directly concerned in the operation." The number of experiments made in the bacteriological investigation of hand sterilization are legion and with practically unanimous conclusions that it is not reliable. It may not be amiss to briefly mention those of Leedham-Green⁷ which follow:

1. Simple washing five to fifteen minutes with soap, hot water, nail brush, and cleaner: 25 experiments, 2 sterile and 23 strongly infected.
2. Soap, water, and sand, as advised by Sanger and Witkowski: no better results.
3. Soap, water, and turpentine (brush dipped from time to time in pure spirits of turpentine): 6 experiments, all infected.
4. Alcohol—hands first washed in several waters to remove dirt, then scrubbed with sterile hot soap and water, and in the middle of the process a sterile ivory nail cleaner used; hands rinsed in sterile water to remove soap, and then treated with alcohol (either absolute or methylated spirits, 96 per cent); now freely rinsed with hot sterilized water and tested: 12 experiments, 2 sterile and 1 almost sterile.
5. Ether—same results.
6. Corrosive sublimate and washing—one to five minutes in solution of corrosive sublimate from 1:1000 to 1:5000: 11 experiments, 2 sterile and 4 almost sterile.

Suffice it to say no one has the temerity to state his ability to absolutely sterilize his hands. This being true, it seems necessary to take extra precautions toward protection of the patient

from hand infection. And here I will mention another important point, that of inability to prevent the degree of infection of the hands from increasing during operation, and will speak of it again in discussing the varieties of gloves.

The use of gloves is of rare antiquity. There is reason to believe they were in use twenty-five hundred or three thousand years ago, as it is mentioned in the "Cyropedia" of Xenophon that on one occasion Cyrus, King of the Persians, went without his gloves; and we know that some kind of protective covering for the hands was used by the Greeks and Romans in certain kinds of manual labor, although their precise form is unknown. A pair of gloves are mentioned in the will of Bishop Riculfus, who died in 915. Henry II. was buried in them in 1189. They came into general use in England in the thirteenth century. The costumes worn by our forefathers to keep away the plague were not complete without the gloves, and the finished surgeon wards off the surgical plague by wearing the addition to his uniform of impermeable, sterile gloves. It has now come to be considered a part of the abdominal surgeon's technique to wear sterilized, impermeable gloves during operations. Some, however, are wearing permeable or slightly permeable ones for various reasons, such as increased tactile sensibility of finger tips, durability, and cheapness. Unquestionably these men are doing better than wearing no gloves. I have been unable to learn who first used gloves in surgery, though Keen, McBurney, and others claim Halsted was the first. There are a number of claimants for this honor, and it is presumed the work of each was independent.

Various materials have been utilized in glove making for the surgeon. Fine silk, Lisle thread, cotton, rubber, rubber-and-silk, and taffeta are noted. Thomas* prefers buttonless thread gloves, as they are closely woven, fit well, stand any method or amount of sterilization, and cost very little. Other operators prefer other materials. There can be very little doubt the impermeable rubber glove is best, though according to Mikulicz¹ the cloth gloves are very much better than none. He found that on cloth gloves worn during long operations microbes were found but 84 times in 100, while cultures taken from the hand just as it was taken from the glove always—100 in 100—showed microbial growth. He was impressed with the rapid and marked lessening of the proportion of sterile hands during a few minutes following the cleaning. He noticed the proportion of sterile hands was 59 to 78 per cent, and that

a few minutes later this had decreased to 47 per cent and even less. This was accounted for by the bacteria on the surface of the skin being killed or removed, and later, by movements, perspiration, etc., germs came from the deeper recesses of it and reinfected the surface. He is well pleased with the use of gloves, as evidenced by his statement that they have contributed to carry his recovery rate from 83 to 94 per cent and with less operation morbidity.

Attempts have been made to render the cloth gloves impermeable by the application of oil, turpentine, and other substances. C. Menge, of Leipzig, has succeeded fairly well by the following process: they are oven-dried, soaked in alcohol (absolute), then in pure xylol, again in fresh xylol; fifteen minutes in a 10 per cent solution of a low melting point paraffin in xylol and then wrung out and dried. Foote' in speaking of this process commends it highly, calling attention to its close comparison to the process of preparing microscopical material for embedding, while Lockett " claims it to be very defective.

If by any safe process cloth gloves can be rendered impermeable, their superiority over rubber gloves is at once established. Otherwise the rubber ones are preferable from their impermeability. Zweifel wears linen sleeves that fit close to the gloves. Robb wears rubber gauntlets. Zweifel's gloves are heavier than those in use in this country, have no finger tips, but separate fingers over which he wears thin, long rubber cots. This is from economical reasons.

On returning from my summer vacation last year I began the employment of rubber gloves for myself and chief assistant, and cotton gloves for the nurses handling instruments and sponges, in my abdominal work in Columbia Hospital and later in my Providence Hospital service. In but two cases has there been infection, and in both of these bowel resections were made and bacteriological examinations demonstrated the colon bacillus to be the only organism present. The cloth gloves were sterilized by moist heat. The rubber ones were boiled five minutes in a 1:64 solution of carbonate of soda, the gloves being carefully filled with the same solution. They were then soaked five minutes in a 1:2000 corrosive sublimate solution, and dried. The gloves may be sterilized by submitting them for thirty minutes to formaldehyde gas in a formaldehyde sterilizer, care being exercised that the surfaces be kept apart. It is said to injure them less than other methods. Sterilized talcum powder or French chalk is usually employed

as a lubricant for fitting them to the hands, though corrosive sublimate solution and sterilized water have both been used for this purpose, the glove being filled by the fluid and the hand plunged into it. We have cleansed our hands just as carefully to use the gloves as was usual without them. This is necessary, as gloves may accidentally be perforated during operation. Permeable cloth gloves require frequent dipping of hands in antiseptic solution and rinsing with sterilized water or salt solution; or, as is customary in Germany, frequently changing gloves during operation, which to me seems much delay, a matter of importance in some cases.

The advantages of rubber gloves in surgery are, first, protection of patient against infection from operator's hands, and, second, protection of the operator's hands against infection from the wounds. A number of operators use rubber gloves only when they have been in infectious cases previously and fear carrying infection to cases subsequently operated upon. To me it seems we cannot well be certain any given case has not been infected, and therefore the safer plan is to wear gloves in every case. When we leave a case undoubtedly infected we feel a great degree of safety by having worn the gloves. It is extremely difficult, perhaps impossible, to know our assistants' hands are even as sterile as ours. The use of gloves affords us the satisfaction of knowing their hands, no matter how much soiled, are not to come in contact with the wounds. Thomas, in speaking of private-house work, facetiously says: "Gloves for unknown assistants are excellent, as the awe of the gloved hands prevents assistants from feeling impelled to feel the patient's pulse or open a door or window during the trying vicissitudes of any long operation." It requires considerable courage to thoroughly scrub sore hands, and still more to put them in the position of being readily infected or as easily infecting a surgical wound on a patient. We can get along with less scrubbing with gloves and certainly avoid danger of infecting them. The use of gloves prevents us carrying about on our hands the well-known "operation odors" so objectionable to many people, and permits the surgeon as well as other people to have well-shaped finger nails—a rare condition among surgeons. In emergency work, in which the necessary time for thorough scrubbing is oftentimes ill-spared, as well as when many cases are to be dressed in succession, their use no doubt would be of great convenience and safety.

The objections to the use of gloves in abdominal surgery—a

field requiring so much deftness, such highly developed tactile sense and great speed in manipulative detail—are that some difficulty in threading needles, in tying ligatures, and in manipulating instruments exists, as well as a handicap to the sense of touch. Besides these are such others as expense, estheticism, and an additional complication in the technique of surgical operations. The difficulty in needle-threading is of no moment if one assistant hands instruments and sutures, as ample time for such work is afforded. In case of dispensing with such assistant, ligature carriers, as usually employed by some surgeons, may satisfactorily be brought into use. There is some difficulty in tying ligatures, but a little practice materially lessens this. In handling instruments practice does likewise. After some experience with thin rubber gloves the tactile sense is practically unimpaired. The employment of the advantages of certain positions—Trendelenburg's, for instance—may be said to entirely remove any such difficulty. The expense of anything to alleviate suffering or to prevent death is of very slight moment. To consider the cost of rubber gloves would be like ignoring aseptic and antiseptic agents for economical reasons.

If gloves are as beneficial as they have been proved, then the surgeon using them should be regarded as doing his duty rather than as using them for affectation. It is to be regretted that surgical technique is so complicated, and all agree that one simpler than we usually employ, and as efficacious, would be a great advancement.

The use of rubber gloves does complicate it more in some cases if the hand sterilization is carried out. But to me it seems these extra complications are beneficial, as they instill into assistants a proper respect for aseptic work. I feel the employment of rubber gloves in abdominal surgery is a decided step in advance, and the abdominal surgeon should consider their use as necessary as sterilization of his paraphernalia.

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