Gloving for the Protection of Blood Borne Infections

Surgical gloves were introduced in the early years of the 20th Century by William Stewart Halstead. The gloves were initially used to protect nurse's and surgeon's hands from the strong antiseptic chemicals used during surgery. They soon became an essential requirement for asepsis and today, along with procedure gloves; they are seen to protect both staff and patients from blood borne infections such as hepatitis B, C and HIV.[1] It was found that the most common areas of contamination with infectious biological material were the hands and fingers. Such contamination occurs because of the failure of glove protection.[2] As there are several factors that may relate to the failure of glove protection, several proposed methods to minimize such problems have been reported. This brief review is intended to bring recent information in various aspects of gloving for the protection of blood borne infections for proper use of gloves in our present clinical practice.[3]

Incidence of Glove Perforation

The overall glove perforation during surgery varies among procedures and has been reported to occur between 3 to 32% of the operation.[4,5] The rate of glove perforation was reported to occur around 3.3% to 12.3% of the gloves used.[5,6] The perforation of the single glove or the outer glove of double-gloving method was found to be of the same rate without significant difference in similar surgery. This means that wearing two pairs of latex gloves does not cause the glove wearer to sustain more perforations to their outermost gloves, even the double-gloving may cause in the less effectiveness of the dexterity or the clumsiness of the hands.[7] Although the outer-glove perforation rate may be close to that of the single glove, it was found that the perforations occurred in the inner glove was very minimal of 1.6% to 3.1% of overall glove perforation.[3] Malhorta et al found that matching perforations were found in 4.6% of case with glove perforation of both outer and inner gloves. Thus, the protection offered by double gloves was 95.4% even if the outer gloves were perforated.[7] One study reports a reduction rate of contamination to the surgeon hand was thirteen times lesser when compared to the single-gloving technique.[8] Wearing two pairs of latex gloves is now being accepted for its significant reduction of the number of perforations to the innermost glove.

Mechanical Resistance and Glove Perforation

The alteration of inherent mechanical resistance of latex glove has been found to be related with hydration, stretching load and duration of its use. Thirty minutes of surgical use was associated with measurable hydration of glove latex and a statistically significant loss of electrical and mechanical resistance, with rupture load decreasing by 24%.[9] From this information Hentz et al. advocate changing the glove every 30 minutes during surgery to maintain high level of inherent mechanical resistance of the latex glove.[9] The inherent defect may also occur from the process of sterilization, packaging and quality control process. Even in using brand-new latex gloves, the inner glove perforation or defect without a corresponding outer-glove perforation has been reported.[7] One study reports a defect or perforation of unused gloves at emergency department occurs up to 1.6% of the total available gloves.[7] This inherent mechanical resistance has been a greater concern for the safety of the recycled-glove use. Boiling the gloves in the autoclave at 125 degrees Celsius causes the gloves to stick to each other. Separating them causes tiny tears and holes through which microorganisms can pass.[9]

Glove perforation was also found related to the type of surgery (minor versus major), the related equipments used, exposure to the sharp instrument or bony spike along with the duration of the procedure. Based on the specialty of surgical operation, the inuse acquired instrumental and mechanical perforation rate ranged from 4.6% to 12.15% in urologic operations.[6] For gynecologic operations the overall glove perforation rate was up to 13.6%.[7] Perforations occurred at 18.5% of conventional orthopaedic surgery and 5.8% of arthroscopic procedures.[8] In open abdominal surgery gloves perforation occurred 9.6% while laparoscopic operations glove perforation occurred only 3.3%.[5] The ratios of the incidences of glove perforation among. surgeons, first assistant and second assistants was reported 23:7:1 in one study.[7] Non dominant (usuall left side) index finger was the most common site of-glove perforation in most studies[6,11] while one study reports that a long finger of the non-dominant hand to be the most common site.[7]

Non-touch technique (the manipulation of the wound edges with instrument only) has been advocate for laparotomy wound closure to minimize the chance of glove per foration. The study of Corlett et al., showed that no-touch technique could significantly reduce the number of glove perforation (about 5 times lesser) in comparison to the conventional hand-in technique. Such no touch technique can also be applied in other surgical procedure.[12]

Glove Changing

Apart from the inherent mechanical resistance which will be diminished with duration of usage, the long duration of operation has been contributed to the higher incidence of glove perforation. Surgeries lasting for more than 40 minutes had a significant higher perforation rate compared to those finished in less than or equal to 40 minutes in gynecologic operation (18.6% versus 7.6%).[7] It has been found that the operation longer than two hours was associated with increased rates of perforation.[13] It was

found that less than one-third of the perforated outer-gloves in double-gloving method, were changed by the surgeon during the operation. This may due to the undetected condition of the glove perforation. To facilitate early detection of glove perforation, the indicator gloves (coloured latex gloves worn underneath latex gloves) has been developed.[14] Three trials compared double latex gloves versus double latex indicator gloves. These trials showed similar numbers of perforations to both the innermost and the outermost gloves for both gloving groups. Perforations to the outermost gloves were detected more easily when double latex indicator gloves were worn.[3] However, Tanner and Parkinson[3] found that wearing double latex indicator gloves did not increase the detection of perforations to the innermost gloves. This was contradictory to that reported by Laine and Aarnio[8] who found that the combination of two regular gloves was much less efficient than double indicator gloves when comparing the rate of perforation of the inner glove when the outer had been damaged (24% vs. 4.9%; p = 0.02).

Special Gloves

The commonly used for gloving by medical personnel are the latex gloves and the vinyl gloves. However, the latex gloves were found to be superior to vinyl gloves as barriers to water leakage and viral penetration.[15] This makes the latex gloves to become most commonly used in surgery. Although the latex gloves and the double gloving method are well accepted policy as standard recommendation, there have been emphases on the different material with higher mechanical resistance for gloving in special operation such as arthroplasty in orthopaedic surgery. Several special gloves have been developed and the results of their use have been reported as follow[3]:

Orthopaedic gloves which are thicker than standard latex gloves. There was no difference in the number of perforations when using a single pair of latex orthopaedic gloves compared to the innermost gloves when wearing double latex gloves.

Glove liners which is an insert worn between two pairs of latex gloves. The trials compared double latex gloves versus double latex gloves with liners showed a significant reduction in the number of perforations to the innermost glove when a glove liner was worn between two pairs of latex gloves.

Cloth gloves which are usually worn on top of latex gloves. The trials compared double latex gloves versus latex inner with cloth outer gloves showed that wearing a cloth outer glove significantly reduced the number of perforations to the innermost latex glove.

Steel weave gloves which are worn on top of latex gloves. One trial compared double latex gloves versus latex inner with steel weave outer gloves. This trial showed no reduction in the number of perforations to the innermost glove when wearing a steel weave outer glove.[3]

Latex Allergies

There has been a dramatic increase in the incidence of latex allergies in health care workers followed the increasing in latex glove usage driven by the release of Universal Precautions issued by the Centers for Disease Control (CDC) in response to the rise of HIV and other blood-borne pathogens. When one is sensitized, it is quite difficult to relief. Because there is so much latex in everyday life that avoiding this allergen is exceedingly difficult and there are numerous cross reactants that are present in the environment.[16] The efforts to help minimized such problems have relied on the substitution of other materials for latex or to minimize the allergenicity of the latex material during manufacturing which is still on the way of researching.

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