

# Information concerning the Infection Risks of Sphygmomanometer Cuffs and their Proper Treatment

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## Introduction

A sphygmomanometer is an apparatus used in medical settings every day, along with a thermometer and a stethoscope. Sphygmomanometer cuffs are categorized into reusable cuffs (hereinafter referred to as “sphygmomanometer cuffs”) and single-use cuffs (single-use devices; hereinafter referred to as “SUD cuffs”) (Figure 1). Sphygmomanometer cuffs come into contact with intact skin only and are therefore classified as non-critical in the Spaulding Classification.<sup>1,2)</sup> Low-level disinfection or washing is used to treat non-critical apparatuses, but alcohol wipes may be used on sphygmomanometer cuffs.<sup>1,2)</sup>

Are sphygmomanometer cuffs used in clinical settings properly handled? Are they left unclean? Let us discuss the proper handling of cuffs based on actual conditions.



Figure 1 Reusable Cuffs and Single-use Cuffs

## The current state of the handling of sphygmomanometer cuffs

People on whom an apparatus is used (patients) feel discomfort when an obviously contaminated apparatus is used. Users of an apparatus (medical personnel) are naturally aware of obvious contamination. They are undoubtedly aware of an infection control problem when an apparatus is reused without proper treatment, even if there is no obvious contamination. However, proper treatment is not provided. Healthcare-related infection precautions focus on medical apparatuses used in invasive examinations and treatments with a high infection risk, while apparatuses with a lower priority tend to be underestimated.<sup>3)</sup> Sphygmomanometer cuffs are included in the latter apparatuses.

## Management of sphygmomanometer cuffs in COVID-19 care

In the early phase of the COVID-19 pandemic, COVID-19 was an unknown infectious disease, so stringent precautions were taken to prevent the spread of infection via the environment and equipment. We also frequently used SUD cuffs in order to ensure thorough contact prevention at our facilities. The following studies pertain to sphygmomanometer cuffs during the COVID-19 pandemic.

In one study, SARS-CoV-2 contamination on the surface of medical devices was evaluated in three long-term care facilities (each with more than 150 inpatients) where an outbreak of COVID-19 was declared.<sup>5)</sup> Samples were taken from 89 places in total. SARS-CoV-2 RNA was detected in six places: sphygmomanometer cuffs of normal adult size (two places), a sphygmomanometer cuff of large adult size, a strap to hold down a sphygmomanometer in a medicine cart, and a tablet display. Of the nine samples related to sphygmomanometer cuffs, four (44%) tested positive. Results suggested that medical devices are potential routes for SARS-CoV-2 infection at long-term care facilities, and the treatment of all medical devices should be enhanced or their shared use among patients should be prohibited.

Next is an observational study to practically evaluate the cleaning of non-critical apparatuses before and after use on patients.<sup>4)</sup> For about one month starting in July 2020, 137 nurses working in inpatient wards and outpatient units were studied, and the practice of cleaning stethoscopes, thermometers, and sphygmomanometers before and after contact with patients was observed in 1,104 sessions. Results indicated the extremely low frequency of the proper treatment of non-critical apparatuses, with no nurse cleaning sphygmomanometer cuffs, four nurses cleaning thermometers before use (2.9%) and seven cleaning them after use (5.1%). A shortage of disinfectants and protective equipment was noted during the COVID-19 pandemic, but knowledge and compliance need to be improved through training.

During a pandemic involving an unknown infectious disease, the use of SUD cuffs in selected settings and for selected patients is reasonable. That said, the inadequate cleaning of sphygmomanometer cuffs during normal times resulted in equivalent or more inadequate control under the restrictions of the COVID-19 pandemic. The risk of a spread of infection cannot be denied.

Next, let us discuss the infection risks of sphygmomanometer cuffs in order to enhance the recognition and provision of necessary treatment.

## Infection risks of sphygmomanometer cuffs

According to one source, up to one-third of all nosocomial infections may be prevented through the proper disinfection of devices.<sup>6)</sup> In addition, studies over many years have reported evaluating potential infection risks in sphygmomanometer cuffs by means such as detecting microorganisms or pathogenic microorganisms,<sup>7-11)</sup> finding a genetic association between strains isolated from sphygmomanometer cuffs and those isolated from patients,<sup>12)</sup> and finding that sphygmomanometer cuffs are possible involved in outbreaks caused by resistant bacteria.<sup>13)</sup> Some examples are provided below.

At 14 inpatient wards and outpatient units in a general hospital in London, the presence of bacteria was evaluated on 120 sphygmomanometer cuffs.<sup>9)</sup> Bacteria were detected on 85% (102 cuffs), with the highest rate of contamination in the outpatient unit at 90%. There were differences between bacteria isolated in inpatient wards and outpatient units, with the common bacteria being coagulase-negative staphylococci in inpatient wards and diphtheroids in outpatient units. This study emphasized the necessity of eliminating potential infection risks.

The potential contribution of thermometers and sphygmomanometer cuffs to healthcare-associated infections was evaluated at a teaching hospital in Nigeria.<sup>10)</sup> Among the 58 tested thermometers, 36 (62.1%) were contaminated, and so were 23 (82.1%) of 28 tested sphygmomanometer cuffs. *Staphylococcus aureus*, the most common isolated bacterium, accounted for 82.1% of bacteria isolated from thermometers and 73.9% isolated from sphygmomanometer cuffs. *Pseudomonas aeruginosa* accounted for 8.3% of bacteria isolated from thermometers and 4.4% isolated from sphygmomanometer cuffs. *Enterococcus* accounted for 5.6% of bacteria isolated from thermometers and 13.0% isolated from sphygmomanometer cuffs. The maximum rate of contamination was 80% for thermometers and 100% for sphygmomanometer cuffs in nursing units and inpatient wards. These results emphasize the necessity of disinfecting thermometers and sphygmomanometer cuffs between patients in order to minimize the nosocomial transmission of resistant bacteria caused by the exchange of non-critical apparatuses used by medical staff.

In 2022, a cross-sectional study of five types of medical facilities evaluated the presence of pathogenic microorganisms on the inside of sphygmomanometer cuffs.<sup>11</sup> Of 372 samples in total, microorganisms were detected in 257 (69.1%). *Bacillus cereus* was detected most frequently (81 samples, 31.5%), followed by *Staphylococcus* (69 samples, 26.8%). The study stated that results indicated the presence of microorganisms on sphygmomanometer cuffs in clinical settings, even though almost all of the medical facilities had established infection control policies and procedures.

At a teaching hospital, bacterial contamination was evaluated on 203 sphygmomanometer cuffs used in 18 hospital units from January to March 2003.<sup>12</sup> Of the 203 cuffs evaluated, contamination was observed at a level of 100 colonies per 25 square centimeter unit or higher on the inside of 92 cuffs (45%) and on the outside of 46 cuffs (23%). The rate of contamination was the highest on the inside of sphygmomanometer cuffs; contamination was detected on 20 (83%) of 24 cuffs stored in the intensive care unit (ICU) and on 27 (77%) of 35 cuffs placed in nurse trollies. That said, no high-level contamination was detected on any of the 18 cuffs that were left unused after the last decontamination. Pathogenic microorganisms were isolated from 27 (13%) of 203 cuffs; *Staphylococcus aureus* was detected on 20 cuffs, including MRSA on 9 cuffs. In four patients using dedicated sphygmomanometers, a genetic association was noted between strains isolated from the sphygmomanometers and those isolated from the patients. The study stated that sphygmomanometer cuffs needed to be regarded as a potential vector for pathogenic microorganisms between patients and that verified procedures for their use and maintenance needed to be urgently established.

During an outbreak of carbapenem-resistant *Acinetobacter baumannii* (CRAB) in an intensive care unit, 20 patients were infected, including 15 in the ICU, and the only possible source of infection was sphygmomanometer cuffs.<sup>13</sup> The outbreak subsided after switching the cuffs to those that could be immersed in a disinfectant. The study stated that the outbreak of CRAB was difficult to control and that permanent colonies may have formed due to unforeseen causes.

Similarly, studies in Japan have reported on the contamination of sphygmomanometer cuffs with MRSA, and studies have examined methods of treatment.<sup>14-17</sup> These are long-standing issues.

## Difficulty of proper management of sphygmomanometer cuffs

Several previous studies have examined thermometers as well as on sphygmomanometer cuffs.<sup>4,10</sup> In clinical settings, dedicated thermometers are used for individual patients in principle, and alcohol disinfection or other measures are taken before shared use between patients. This is a feasible method considering the number of apparatuses and the burden of the task. That said, sphygmomanometer cuffs are not for dedicated use by individuals in principle, and their materials and structure do not enable easy cleaning. A method of treatment (management) that can be continued reliably needs to be devised based on a recognition of this difference.

## Need to consider the requirements for sphygmomanometer cuffs before considering treatment

The management of sphygmomanometer cuffs needs to be discussed, predicated on fulfilling their intended use. The requirements for sphygmomanometer cuffs from the viewpoint of users are listed in [Table 1](#) on the next page.

## Importance of establishing procedures

The importance of hand hygiene to prevent cross-contamination is recognized by all medical personnel. That said, their hands are not the only thing that moves from patient to patient. The same holds true for sphygmomanometer cuffs. Therefore, procedures need to be established and practices need to be improved. The previous studies mentioned earlier noted that one of the reasons why bacterial contamination was detected, indicating inadequate treatment, was the absence of established treatment procedures.<sup>6,7,11,12</sup> Feasible procedures that consider infection risks and the actual conditions of use need to be established.

**Table 1** Requirements for Sphygmomanometer Cuffs from the Viewpoint of Users

Item	Description
Accurate measurement	<p>There are no errors in measurements due to cuffs</p> <ul style="list-style-type: none"> <li>● Cuffs have a certain durability, with little decline in functionality as a result of treatment</li> <li>● There are many cuff sizes, so appropriate cuffs can be selected for patients to be measured</li> </ul>
No harm to the individuals on whom cuffs are used (such as effects on the skin, including subcutaneous bleeding, skin disorders, and allergies)	<p>There is no subcutaneous bleeding caused by measurement, skin disorders caused by cuff attachment for a prolonged period, application of excessive pressure due to a bent tube, or other problems</p> <ul style="list-style-type: none"> <li>● A structure that minimizes the pinching of the skin and the bending of the tube or a structure that minimizes harm even if pinching or bending occurs</li> <li>● Materials that cause little skin irritation, such as latex-free materials</li> </ul>
Simple and easy treatment and handling	<p>The steps in treatment are simple, easy, and reliable</p> <ul style="list-style-type: none"> <li>● The treatment procedures accord with the material and structure of the cuff</li> <li>● The cuff is heat-resistant and can be treated with hot water (e.g., at 80 °C for 10 minutes), achieving high-level disinfection</li> <li>● Alcohol wipes can be used, achieving intermediate-level disinfection</li> <li>● The cuff can be machine-cleaned (washed), with easy disassembly and assembly for washing</li> <li>● The materials allow cleaning with simple and easy treatment (such as wiping disinfection with a cloth containing low- to intermediate-level disinfectant)</li> </ul>
Compatibility with monitors enabling versatile use	<p>The cuff is compatible with many types of monitors used in clinical settings, enabling versatile use</p> <ul style="list-style-type: none"> <li>● The use of a single cuff can prevent cross-contamination</li> </ul>
Highly cost-effective	<p>Consider the proper uses of reusable cuffs and SUD cuffs</p> <ul style="list-style-type: none"> <li>● Select reusable cuffs or SUD cuffs based on a proper evaluation of their suitability</li> </ul>

## Use of SUD cuffs

Let us discuss the use of SUD cuffs as one of the methods of managing sphygmomanometer cuffs.<sup>5,7,10</sup> Given that pathogenic microorganisms are present on sphygmomanometer cuffs even in current clinical settings with established policies and procedures for infection control, the use of SUD cuffs has been described as a possible method for effective risk reduction.<sup>11</sup>

SUD cuffs are effective at avoiding cross-contamination risks based on the use of one cuff per patient and the reduction in treatment costs (including human labor) for reuse. That said, SUD cuffs involve issues including higher product costs and increased medical waste. Reasonable and effective use of SUD cuffs would be possible by considering their suitability and use.

### Suitability of SUD cuffs

The use of SUD cuffs should be considered in light of subsequent treatment under circumstances with a high risk of cross-contamination, such as massive bleeding due to trauma in an emergency room and an infectious disease suspected based on skin symptoms. SUD cuffs are also suitable in instances where a drug-resistant bacterium requiring contact precautions is detected<sup>18</sup> or where there is a high risk of environmental contamination and *Clostridioides difficile*, norovirus, or the like is detected.

### Management of SUD cuffs

In principle, one SUD cuff is used per patient and it is disposed of after use. The cuff should be closely observed for damage during use and replaced with a new cuff if there are abnormalities. The cuff may continue to be used on the same patient if contamination can be removed with wipes. However, the cuff should be replaced if there is severe contamination. A point to remember is that functionality is not guaranteed after treatment by a method other than that directed by the manufacturer.

## Use of (reusable) sphygmomanometer cuffs

### Management of sphygmomanometer cuffs

Even reusable cuffs are subject to deterioration as a result of use, treatment, and storage. Therefore, reusable cuffs should also be replaced at an appropriate interval for safe use. For the replacement interval, refer to the instruction manual from the manufacturer, such as “to be replaced after about one year from the start of use (the service life of the inner bag is about 30,000 compressions and decompressions).”<sup>19)</sup>

In actual practice, appropriate management should be implemented considering the frequency of use and the extent of contamination in the facility, with a predetermined guideline for replacement as well as periodic inspections followed by prompt replacement if abnormalities are detected.

### Procedures for treating sphygmomanometer cuffs

In principle, cuffs should be properly treated in accordance with the instruction manual from the manufacturer. The treatment procedures should also be based on the Guidelines for the Prevention of Infection via Medical Devices.<sup>20)</sup>

For necessary treatment to be provided safely and reliably, the structure and materials of a cuff should be understood. A sphygmomanometer cuff has a double structure comprising an inner bag and an outer bag (Figure 2). Each bag should be disassembled and treated separately. The basics of treatment and precautions are listed in Table 2. A method should be recommended by the manufacturer and that method should be used.

If a disinfectant is used to treat a sphygmomanometer cuff, the basic rule is to use the specified concentration and contact time.<sup>22)</sup> If there is blood contamination, the contamination is physically removed, followed by wiping disinfection with sodium hypochlorite of 1,000 ppm (0.1%),<sup>21)</sup> an alcohol-based disinfectant, or other intermediate-level disinfectants.

### Precautions regarding treatment procedures

As mentioned earlier, sphygmomanometer cuffs are non-critical apparatuses that come into contact with intact skin only. Although disinfection is not necessarily required, the cuffs frequently come into contact with the skin of patients and the hands of medical personnel, so periodic cleaning and wiping must be performed.

Under contact precautions, a dedicated non-critical apparatus needs to be used for each patient, a disposable apparatus needs to be used, or disinfection needs to be performed before shared use between patients. Use a dedicated non-critical apparatus for each patient is recommended in instances where a patient has been found to be infected with or carrying MRSA, VRE, or other multidrug-resistant bacteria.<sup>23)</sup>

Given these points, an easy treatment procedure in routine practice is wiping disinfection with a cloth containing an alcohol-based disinfectant for low- to intermediate-level disinfection. A study has reported using an ethanol-based disinfectant that is readily available in surroundings. That study is mentioned on the next page.

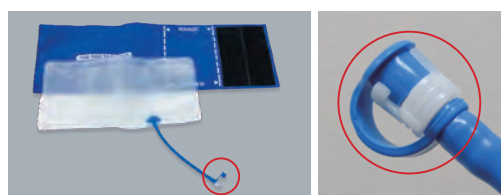


Figure 2 Structure of a Sphygmomanometer Cuff

Table 2 Procedures for Treating Sphygmomanometer Cuffs

	Outer bag	Inner bag
Method	<ul style="list-style-type: none"> <li>● Wiping disinfection with an alcohol-based disinfectant (ethanol for disinfection, 70% isopropanol, or an ethanol solution with isopropanol added)<sup>2,20,21)</sup></li> <li>● Cleaning disinfection in a washing machine with hot water (e.g., at 70 to 80°C for 10 minutes)<sup>2)</sup></li> <li>● Immersion in a 0.1% amphoteric surfactant for 30 minutes followed by washing</li> <li>● Washing with a neutral detergent followed by rinsing and drying</li> </ul>	<ul style="list-style-type: none"> <li>● Wiping disinfection with an alcohol-based disinfectant (ethanol for disinfection, 70% isopropanol, or an ethanol solution with isopropanol added)<sup>2,20,21)</sup></li> <li>● Washing with a neutral detergent followed by rinsing and drying</li> </ul>
Precautions	<ul style="list-style-type: none"> <li>● Washing is recommended if there is a stain<sup>2)</sup></li> <li>● The outer bag is replaced with a new one when the line indicators for proper fitting become faded and illegible</li> </ul>	<ul style="list-style-type: none"> <li>● The inner bag is completely deflated before securely closing the waterproof cap</li> <li>* An unclosed or loosely closed waterproof cap will allow the entry of water into the inner bag and may result in the failure of the main unit</li> <li>● When placing an inner bag inside the outer bag, storage conditions are carefully checked, e.g., the inner bag is not folded</li> </ul>

A study indicated the effectiveness of ethanol-based hand sanitizers for sphygmomanometer cuffs.<sup>24</sup> The study compared the effects of ethanol-based hand sanitizers and detergents/disinfectants on potential bacteria and microorganisms on 30 cuffs. Results suggested that both means were effective, with no significant differences between the two. The study stated that although hand sanitizers are readily available, the skin softener (emollient ingredient) contained in hand sanitizers accumulates as an adhesive residual on the cuff surface and the effects of the accumulation on effective disinfection are unknown, so periodic cleaning is necessary.

The Velcro portion of a sphygmomanometer cuff is difficult to disinfect,<sup>17</sup> and microorganisms are detected there.<sup>13</sup> A feasible treatment after each use, considering simplicity, ease, and effectiveness, would be wiping disinfection with a low-to intermediate-level disinfectant. If dust or dirt is found on the Velcro portion or if there is obvious contamination, washing (cleaning) should be performed in principle. Washing with hot water (cleaning and disinfection) would, if possible, be more effective. Periodic washing at a specified interval, such as once every two weeks,<sup>17</sup> would be an option. Rules for treatment should be established in light of the materials, frequency of use, and other factors for the products used at your facility.

## Conclusion

This article has reminded us that the proper management of sphygmomanometer cuffs is an issue worldwide. The extent to which non-critical apparatuses should be treated needs to be determined by comparing the labor and cost involved with the necessity. Treatment procedures need to be established and the publication of and training in those procedures needs to be conducted to ensure that minimum required procedures are followed. I would be pleased if this article is of any help to that end.

### Cuffs featured in this article

YP-710T Infant  
YP-714T Adult (Large)  
YP-842T Adult (Small), Disposable

YP-711T Child  
YP-715T Thigh  
YP-843T Adult (Standard), Disposable

YP-712T Adult (Small)  
YP-840T Infant, Disposable  
YP-844T Adult (Large), Disposable

YP-713T Adult (Standard)  
YP-841T Child, Disposable  
YP-845T Thigh, Disposable

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