



Fewer nosocomial infections due to double gloving

Hospital acquired infections are still on the rise. With renewed efforts the WHO intends to increase problem awareness and improve preventive measures, particularly concerning hand hygiene: By means of systematic hand disinfection, optimised glove use and double gloving numerous nosocomial infections can be avoided – Sempermed informs on the latest data and recommendations.

Nosocomial infections ...

...are, according to CDC definition, infections coinciding with a medical measure which did not exist before. Infections which were acquired during a hospital stay and only occur after the patient's discharge are also considered to have a nosocomial origin.^[1] In practice, most infections that become clinically evident within 48 hours of hospitalization are considered nosocomial.^[2]

In hospitals there are many people carrying pathogens and within hours the bacterial flora of a newly admitted patient begins to acquire the characteri-

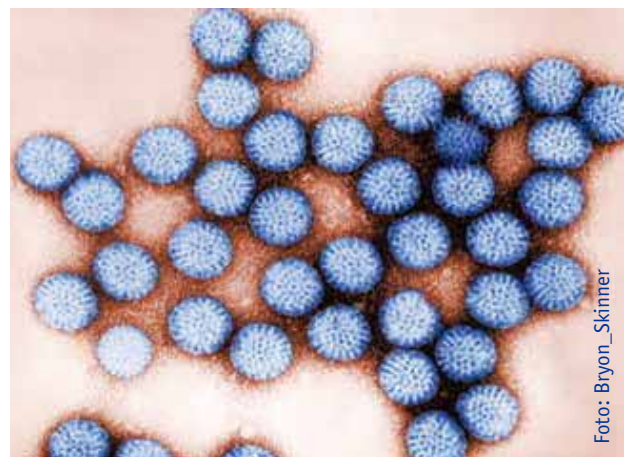
stics of the surroundings – hospital pathogens colonize the skin, respiratory and urogenital tract. Most frequently nosocomial infections are caused by viruses (e.g. influenza, rota viruses); Bacteria and fungi are less common, they are associated however with significantly higher suffering and mortality.^[2]

Infection risk

The infection risk depends on the pathogen (e.g. virulence), the host (e.g. weak immune system) and the environment (e.g. intensive care unit). The risk factors for the invasion of a patient with pathogenic organisms can be categorized into 3 areas:^[2]



E. coli



Rotavirus

Foto: Bryon_Skinner

- **iatrogenic:** e.g. hands of medical personnel, invasive procedures, antibiotic use, operation type, duration and technique, implants, medical products, instruments
- **organizational:** e.g. arrangement/number of beds, contaminated food, airconditioning systems or water systems
- **patientrelated:** e.g. severity of illness, immunocompromised state, smoking, age, previous/comorbid illnesses, length of stay.

Apart from the patients the medical staff also runs a risk of contracting nosocomial infections like influenza, SARS, hepatitis B, hepatitis C, HIV or tuberculosis.^[3]

Frequency

Nosocomial infections are some of the main causes for complications and death of hospitalized patients. Nosocomial infections are estimated to more than double the morbidity and mortality risks of any admitted patient.^[2] 5-15% of hospital patients in industrialized countries are affected, in intensive care units the rate is significantly higher: 9-37% (Europe) or 12-80% (US).^[3]

The most common nosocomial infections are catheter-associated urinary tract infections (approx. 42%), pneumonias associated with artificial respiration (approx. 21%) and postoperative wound infections (approx. 16%).^[4]

PATHOGEN	PERSISTENCE ON HANDS
Staphylococcus aureus	≥ 150 minutes
Pseudomonas spp.	30-180 minutes
Escherichia coli	6-90 minutes
Yeast fungi incl. Candida spp.	1 hour
Rota virus	up to 4 hours

Problems

The consequences of nosocomial infections are serious and include, for example, longer (often double) hospital stay, additional medical measures, long-term disabilities, increased resistance to antibiotics, more deaths, higher costs and emotional stress for the patients and their families.^[3] These problems are aggravated by the fact that nosocomial infections can quickly spread to other institutions (e.g. when patients are transferred) and even other countries as has been demonstrated by the international occurrence of MRSA and SARS.^[5] Also the current H1N1 influenza („swine flu“) was acquired by several people in hospital, cases in which other patients or staff were infected are also known.

Hands as the main source of transmission

Pathogens are transmitted by direct (e.g. hands) or indirect (e.g. droplet infection) transmission. The time for which microorganisms persist on the hands after a contact with patients or contaminated objects/surfaces varies (reference value issued by the WHO: 2-60 minutes, in specific studies up to 4 hours were measured – see table.^[4]) The hands of healthcare personnel are considered the main source of transmission (up to 90%) of nosocomial infections. Thus hand hygiene is regarded the fundamental measure in preventing nosocomial infections and the increase in antibiotics resistance.

The connection between more thorough hand hygiene and lower infection and crossinfection rates has often been documented.^[6]

In order not to convey the so-called transient skin flora (temporary colonies of microorganisms) it is necessary to disinfect the hands regularly – even before and after wearing medical gloves. Obviously the hands disinfection behaviour leaves much to be desired: According to current observation studies hospital staff disinfect their hands 1.7 – 15.2 times per hour for 6.6 – 30 seconds. The compliance rates for hands disinfection are worldwide very low and amount to an average of 38.7%.^[3] Studies have shown that by means of focused compliance improvement in hands disinfection nosocomial infections may be reduced by up to 40%.^[4]

Prevention

The two most essential measures for preventing nosocomial infections are the strict compliance with hygiene strategies and the focused, restrained application of antibiotics. With regard to hand hygiene, regular and thorough disinfection of the hands as well as wearing medical gloves as barrier protection is crucial. Additionally it has been documented that a continuous, systematic recording and assessment of nosocomial infections and pathogens with special resistances (surveillance incl. anonymised

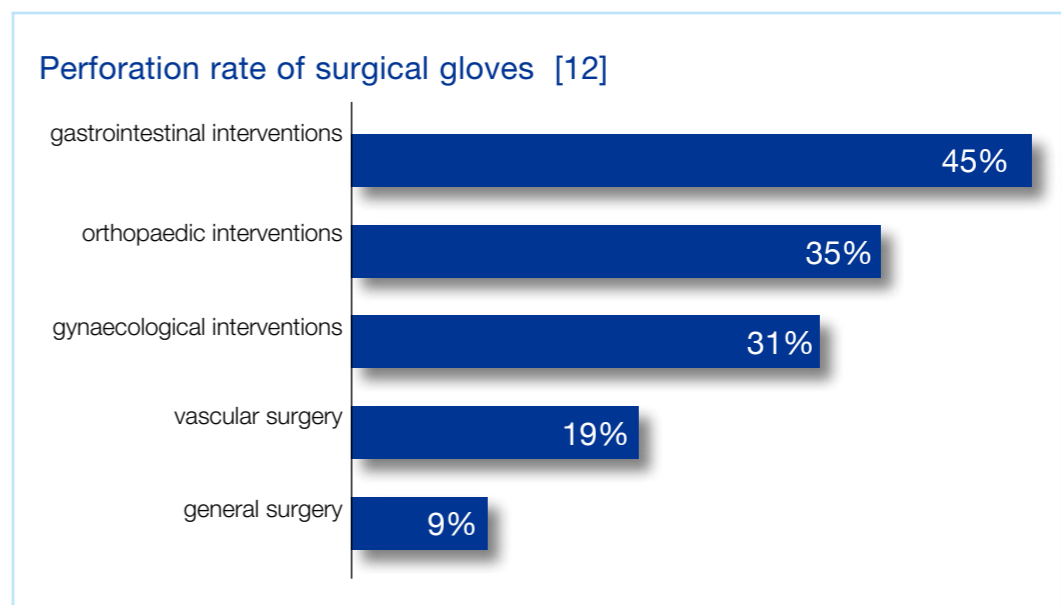
feedback to the affected organizational units) is linked to their decrease.^[6]

In 2009 the WHO published new guidelines on hand hygiene and started a campaign for their practical implementation in order to combat nosocomial infections. „Clean Care is Safer Care“ aims at reducing the transmission of pathogens to patients and health care personnel by improving hand hygiene habits. The core of the new WHO guidelines are their consensus- and evidencebased recommendations – for example the 5 indications and technique of alcoholic hand disinfection as well as the correct use of gloves, including the correct technique of donning and taking them off.^[3]

Even the best protection may perforate!

Medical gloves are highly effective in disrupting the infection chain and providing mutual protection to medical staff and patient – as long as they are undamaged (consider wearing time and glove change, compare AMWF guideline). Only impermeable, intact and non-perforated gloves provide reliable protection against a contamination of the hands with pathogens and completely eliminate the risk of an infection or transmission of pathogens.^[7]

During invasive measures, particularly during surgical interventions, gloves are very often perforated. These perforations mostly remain undetected and almost always involve damage to the hand skin. In most cases the thumb and index finger of the non-



dominating hand are injured, for example when re-capping syringes, closing wounds, passing on or disposing of instruments, working on the bone, the sight on the operation area is bad or in emergencies.^[8] Even the smallest prick injuries may be enough to cause an infection, 9 out of 10 glove perforations, however, go unnoticed. This poses a risk to the user as well as to the patient as glove juice (perspiration with skin germs) may escape.^[8,9]



Perforation

Recently it has been discovered, for instance, that perforated surgical gloves double the risk of postoperative wound infections.^[10]

The perforation rate increases according to wearing time and strain, therefore it is recommended to regularly change the gloves. Furthermore perforations may be prevented by not wearing jewellery beneath the gloves. If glove perforations are detected, they have to be documented and reported to the company doctor.^[11]

Growing trend: Take 2

For an optimized protection against infections it makes sense to wear 2 gloves on top of each other. This has already become routine for an increasing number of operation teams in Europe and the US. The advantage is as plain as can be: the outer pair protects the inner pair. But studies on glove safety have

discovered even more: Double gloving reduces the perforation risk of the inner glove on average by the 10-fold and the transmitted amount of blood by at least the 6-fold.^[11] After a perforation of the outer glove, the inner glove stays intact in up to 82% of the cases.^[8] A recent systematic Cochrane-Analysis has demonstrated that single gloves show 4.1 times more perforations than the inner gloves of surgical gloves worn on top of each other. During an operation 90-92% more perforations are detected, if 2 pairs of gloves are worn. Moreover this metaanalysis of 34 studies has not registered any impairment of surgical skill (tactile sensitivity, dexterity) caused by the double latex layer.^[9]

Double gloving is widely accepted and is getting more and more common in surgery. This seems to be particularly due to the fact that surgical gloves worn on top of each other quickly show perforations of the outer glove, which constitute an infection hazard. If liquid soaks in between the gloves, it discolors the area surrounding the perforation and forms a clearly visible stain so that the outer glove can be changed immediately.^[11] Gloves of different colours are not necessarily required as (any) liquid soaking through the perforated outer glove will show in any case. Even when 2 gloves of the same colour are used, for optical reasons the wet area appears to be darker, the stain just is not as dark as on differently coloured gloves.

According to the latest scientific literature there is no doubt: Double gloving is to be recommended to surgical staff for all surgical interventions and is to be preferred to single gloves as it considerably reduces the frequency of infections and injuries.^[7,11] From the point of view of hospital hygiene and, thus, preventive medicine double gloving is considered a relevant measure to lower glove perforation rates as well as to avoid bloodborne infections, improving the safety of staff as well as of patients. Furthermore it is possible to significantly reduce risks as a preventive measure within a short time and with already existing protective equipment.^[7]

Recommendations of double gloving (examples):

- Robert Koch Institute – Guideline:^[13] Perforations of two surgical gloves worn on top of each other are significantly less frequent than those of single gloves.

For invasive interventions with high injury/perforation hazard it is recommended to wear 2 pairs of gloves. In case of intraoperative glove damage the gloves are changed.

- Association of the Scientific Medical Societies in Germany (AWMF) – Guidelines:^[14] Wear gloves only on completely dry hands as skin moist with disinfectants increases the perforation risk.

In view of the perforation risk it is generally recommendable to wear 2 pairs of surgical gloves on top of each other. When wearing 1 pair in abdominal surgery it is recommended to change gloves routinely after 90 minutes as perforation rates rise with the duration of an operation. In case of intraoperative glove damage 2 new surgical gloves have to be donned. If the perforation occurs towards the end of an operation, it may be enough to put a fresh surgical glove over the perforated one.

After taking off the surgical gloves the hands need to be disinfected. Hands may be contaminated with pathogens due to undetected leakages or contact when taking off the gloves.

- BGW (professional organisation of health care workers) (hand hygiene plan for surgical areas):^[15] Wear double gloves during an operation if you are

dealing with a known, infectious patient or if the type of operation entails a higher risk of gloves being damaged.

- SUVA (Swiss accident insurance):^[16] In case of an increased risk of injuries it is recommended to wear 2 pairs of gloves. This can significantly reduce the leakage hazard of the inner glove, particularly during longer operations.

- USA:^[7] In case of an increased risk of injuries it is recommended to wear 2 pairs of gloves. This can significantly reduce the leakage hazard of the inner glove, particularly during longer operations.

Double Sempermed surgical gloves – double protection

Due to the better barrier protection, and thus the considerably lower infection risk for user and patient, Sempermed also recommends double gloving – especially for highrisk patients, vigorous and deep interventions as well as in emergencies and „exposure prone procedures“ (EPPs). Surgical staff should decide on their own which glove size they can wear comfortably on top of each other and which glove material suits them best. – Simply try out different versions! – In order to avoid slipping effects, the outer surgical glove should not be larger than the inner one. Sempermed recommends to use 2 pairs of the



same size or to choose an inner glove half a number (= 1 size) larger than normal and an outer glove of your usual size.

Inside green, outside white – or any way you like

The Sempermed® Supreme green is the ideal inner glove (under glove). The unique green colour of this powderfree surgical glove made of natural latex absorbs the glaring light in the operation theatre which makes it easier for the eyes to adapt and minimises eyestrain. In addition the green colour improves the contrast to the organs and makes perforations of the outer glove more visible (more obvious/darker stain). Its special synthetic lining makes the Sempermed® Supreme green easy to don even with moist hands. This facilitates the intraoperative change of gloves.

The Sempermed® Supreme or the Sempermed® Supreme plus is the perfect outer glove. These two powderfree surgical gloves made of natural latex are particularly skinfriendly due to Sempermeds special leaching process, which reduces skinirritating substances resulting from the production process and natural latex proteins to the absolute minimum. Their patented synthetic lining makes these two premium gloves easy to don and take off. Of course our Sempermed standard guarantees the user excellent fit, high comfort, maximum tactile sensitivity and safe (wet) grip at a good price/performance ratio. Users who want to do without the Sempermed® Supreme greens colour distinction in double gloving may also combine these two surgical gloves: For instance 2 pairs Sempermed® Supreme on top of each other or inside a pair Sempermed® Supreme and outside a pair Sempermed® Supreme plus.

Double protection in synthetic latex

Sempermeds synthetic range provides the optimum solution for double gloving: As a coloured „partner“ for the popular latex- and powderfree surgical glove Sempermed® Syntegra IR made of synthetic polyisoprene (IR) we now offer the new Sempermed® Syntegra green. – Sempermed recommends wearing the Sempermed® Syntegra green as inner glove and the Sempermed® Syntegra IR as outer glove or 2 pairs Sempermed® Syntegra IR on top of each other.

The special polyisoprene formula of the Sempermed® Syntegra IR imitates the structural properties of natural latex (NR) on the highest level of perfection, so that it excels by the same material properties as natural latex gloves but without the risk of latex allergies. Therefore the Sempermed® Syntegra IR is at least on a par with a natural latex glove regarding its elasticity, suppleness, tear resistance, fit, flexibility, tactile sensitivity and safe (wet) grip. Moreover this synthetic glove made in Austria is absolutely skinfriendly and safe, which is due to its innovative accelerator system. Its special weblike lining makes it easy to don and creates a snug feeling on the skin.

The glove portfolio of Sempermed provides personalized solutions for double gloving regarding colour, size and material preferences. For the implementation of this new trend or a broader application of double gloving you therefore have several options of Sempermeds internationally appreciated quality products at your disposal.

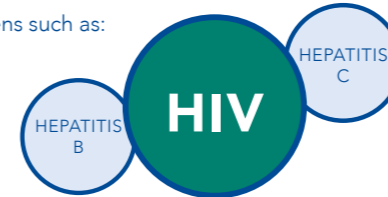


HOW DOES DOUBLE DONNING WITH A COLOURED UNDERGLOVE WORK?

THE RISKS

Studies prove that perforation happens regularly. Double donning reduces the risks caused by perforations.

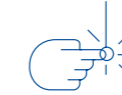
Pathogens such as:



can be transmitted via holes in gloves.



83%
of glove perforations go unnoticed ⁽¹⁾



11-61%
Microholes are found in 11-61% of cases ^(2,3,4,5,6)



REDUCED RISK

82% In up to 82% of cases when the outer glove is perforated, the inner glove still protects from contamination.

-95% The amount of viruses and blood transmitted is reduced by up to 95% ⁽⁸⁾.

ADVANTAGES AT A GLANCE:

- ✓ Sizes can be individually combined
- ✓ Reduced wall thickness – greater sense of touch
- ✓ Special innercoating



COMFORT AND SAFETY GO HAND IN HAND



Sempermed® Supreme green



Sempermed® Syntegra green

¹⁾ Thomas S, Agarwal M, Mehta G. (2001). Intraoperative glove perforation—single versus double donning in protection against skin contamination. Postgrad Med J (2001);77:458–460. ²⁾ Guo, et al (2012) Is double-gloving really protective? American Journal of Surgery, August 2012, Vol 204(2):210-215. ³⁾ Yinusa W, Li YH, Chow W, et al. (2004) Glove punctures in orthopaedic surgery. Int Orthop 2004;28(1):36-39. ⁴⁾ Laine T, Aarnio P. (2001) How often does glove perforation occur in surgery? Comparison between single gloves and a double-gloving system. Am J Surg 2001;181(6):564-566. ⁵⁾ Na'aya HU, Madziga AG, Eni UE. (2009) Prospective randomized assessment of single vs. double-gloving for general surgical procedures. Niger J Med 2009;18(1):73-74. ⁶⁾ Sebold EJ, Jordan LR. (1993) Intraoperative glove perforation. A comparative analysis. Clin Orthop Relat Res 1993;297:242-244. ⁷⁾ Thomas S, Agarwal M, Mehta G. (2001). Intraoperative glove perforation – single versus double donning in protection against skin contamination. Postgrad Med J (2001);77:458–460. ⁸⁾ Berguer R, Heller P. (2005) Strategies for preventing sharps injuries in the operating room. Surgical Clinic of North America. 2005; vol 85: 1299-1305.

REFERENCES:

- [1] NRZ für Surveillance nosokomialer Infektionen: „Definition nosokomialer Infektionen (CDC-Definitionen)“, RKI Berlin 2008
- [2] Nguyen QV: „Hospital Acquired Infections“, eMedicine Medscape, 1/2009
- [3] WHO Guidelines on Hand Hygiene in Health Care, 2009 (Teilnehmerliste „Clean Care is Safer Care“: http://www.who.int/gpsc/5may/registration_update/en/index.html)
- [4] Kampf G, Löffler H, Gastmeier P: „Händehygiene zur Prävention nosokomialer Infektionen“, Dtsch Ärztebl Int 2009;106(4):649-55
- [5] EU-Projekt IPSE: „Improving Patient Safety in Europe – Technical Implementation Report 2005-2008, Vol. 1, 11/2008
- [6] RKI: „Surveillance nosokomialer Infektionen“, Epidemiol Bulletin Nr. 45/2008
- [7] Eikmann T: „Doppelte Handschuhe – eine präventive Maßnahme zur Vermeidung nosokomialer Infektionen im Gesundheitswesen“, Umweltmed Forsch Prax 14(3)2009
- [8] Kralj N: „Prävention von Virusinfektionen durch chirurgische Handschuhe“, medical spezial 1/2007
- [9] Tanner J et Parkinson H: „Double gloving to reduce surgical cross-infection“, Cochrane Database of Systematic Reviews 2009, Issue 4
- [10] Misteli H et al: „Surgical Glove Perforation and the Risk of Surgical Site Infection“, Arch Surg 2009;144(6):553-8
- [11] Kralj N et Hofmann F (Hrsg.): „Technischer Infektionsschutz bei medizinischen Interventionen“, ecomed Medizin, HJR-Verlag Landsberg, 2009
- [12] Hagen G et Arntzen H: „The risk of surgical glove perforations“, Tidsskr Nor Laegeforen, 2007; 127(7): 856-8
- [13] Empfehlung der Kommission für Kommission für Krankenhaushygiene und Infektionsprävention beim RKI, Bundesgesundheitsbl – Gesundheitsforsch – Gesundheitsschutz 3/2007
- [14] AMWF-Leitlinie Nr. 029/027: „Händedesinfektion und Händehygiene“, HygMed 2008;33(7/8): 300-13
- [15] TP-HSP-4: „Hautschutz- und Händehygieneplan für Mitarbeiter im OP-Bereich“, BGW 2008
- [16] Jost M et al.: „Verhütung blutübertragbarer Infektionen im Gesundheitswesen“, suvapro – sicher arbeiten, 8/2009