

Do Sterile Gloves Reduce Nosocomial Infection in the Neonatal Ward?

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Abstract

To determine whether using sterile gloves reduces the incidence of nosocomial infection in the neonatal ward of Srinagarind Hospital, a prospective randomized controlled study was conducted between November 1, 1990 and March 31, 1991. One-hundred two newborn infants were randomly assigned to receive nursing care by using sterile latex gloves or by standard nursing care (control group). There were 60 newborn infants in the gloves group and 42 newborn infants in the control group. Birth weight, gestational age, sex, place of birth and also risk factors predisposing infants to infection were comparable in the two groups. There were 13 (21.7%) infants with nosocomial infection (95% CI=0.11, 0.32) and 30 (50%) *Klebsiella*-colonized infants in the gloves group (95% CI = 0.37, 0.63), as compared to 8 infants with nosocomial infection (19.07%) (95% CI = 0.01, 0.31) and 18 *Klebsiella*-colonized infants in the control group (42.8%) (95% CI = 0.28, 0.58). By survival analysis, there was no significant difference between the two groups ($P > 0.05$) in the probability of patients remaining free of nosocomial infection or *Klebsiella* colonization.

We conclude that there is no statistically significant difference in the incidence of nosocomial infection in the infants who received nursing care by using sterile gloves compared to standard care. Hand washing, careful attention to barrier precautions, adequate staffing, NICU design, prompt case identification and cohorting should be emphasized in order to reduce nosocomial infection. (*J Infect Dis Antimicrob Agents* 1993; 10:1-7)

Key words : Nosocomial infection, newborn, gloves

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เรื่องย่อ

การสวมถุงมือกับการติดเชื้อในโรงพยาบาลในหอผู้ป่วยทารกแรกเกิด โรงพยาบาลศรีนครินทร์
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เพื่อศึกษามลภาวะการสวมถุงมือ ต่อการลดอัตราการติดเชื้อในโรงพยาบาลในหอผู้ป่วยทารกแรก
เกิดโรงพยาบาลศรีนครินทร์ ได้แบ่งทารกแรกเกิด 102 ราย เป็นกลุ่มที่ได้รับการดูแลโดยสวมถุงมือ
ทุกครั้งที่มีสัมผัสเด็ก (กลุ่มศึกษา) จำนวน 60 ราย และกลุ่มที่ได้รับการดูแลโดยวิธีมาตรฐาน (กลุ่มควบคุม)
จำนวน 42 ราย โดยวิธีสุ่มตัวอย่าง ทารกทั้ง 2 กลุ่มได้รับปัจจัยเสี่ยงของการติดเชื้อไม่ต่างกัน พบว่ามี
ทารกที่พบเชื้อ *Klebsiella* โดยที่ไม่เกิดอาการติดเชื้อในกลุ่มศึกษา และกลุ่มควบคุมเท่ากับ 30 ราย คิด
เป็นร้อยละ 50 (95% CI = 0.37, 0.63) และ 18 ราย คิดเป็นร้อยละ 42.8 (95% CI = 0.28, 0.58)
ตามลำดับ และทารกที่เกิดการติดเชื้อในโรงพยาบาลในกลุ่มศึกษา และกลุ่มควบคุมเท่ากับ 13 ราย คิด
เป็นร้อยละ 21.7 (95% CI = 0.11, 0.32) และ 8 ราย คิดเป็นร้อยละ 19.07 (95% CI = 0.01, 0.31)
เช่นกันจากการวิเคราะห์หัตถ์ราปลอดเหตุการณ์พบว่าโอกาสปลอดเชื้อของทารกทั้ง 2 กลุ่มไม่ต่างกัน ($P > 0.05$)
สรุปว่าจากการศึกษานี้ อัตราการพบเชื้อ *Klebsiella* และอัตราการติดเชื้อในโรงพยาบาลในทารกกลุ่มที่
ได้รับการดูแลโดยสวมถุงมือทุกครั้ง ไม่ต่างกับกลุ่มทารกที่ได้รับการดูแลโดยวิธีมาตรฐาน อาจมีปัจจัยอื่น
มาเกี่ยวข้องซึ่งน่าจะต้องมีการศึกษาต่อไป (วารสารโรคติดเชื้อและยาต้านจุลชีพ 2536; 10:1-7.)

Nosocomial infection is still the major problem in the neonatal ward. Overcrowding, understaffing and lack of hand-washing have a significant impact on the incidence of nosocomial infection. The causative organisms are most often transmitted between patients on the hands of medical and nursing personnel (1-3). Using protective isolation should reduce the nosocomial infection rate since many infections are acquired after admission to the hospital and most are also related to surgery or exposure to invasive devices (1,2,4). Several studies have failed to demonstrate the benefit of protective isolation in the NICU (5-9). Klein, et al. (4), concluded that the use of disposable, high-barrier gowns and gloves for the care of selected, high-risk children significantly reduces the incidence of nosocomial infection, is well tolerated and does not compromise the delivery of care.

We report the results of a prospective randomized

controlled study to determine whether using sterile gloves reduces the incidence of nosocomial infection in the neonatal ward.

MATERIALS AND METHODS

Characteristics of the neonatal ward

Srinagarind Hospital is a 750-bed university hospital serving 1,666,671 people in Khon Kaen Province(7) and is a referral hospital for the other 16 provinces in the northeastern part of Thailand.

The neonatal ward has a capacity for 30 newborn infants, including 7 intensive care patients, with one isolation room. There are another three isolation rooms in the neonatal ward. Hand washing facilities are available in each isolation room. Another six facilities are located in other patient's area. The nursery is staffed by 5-6 nurses who work 8-hrs shifts and by two residents

and two externs, each of whom is on call every third night.

Study population and design

Newborn infants admitted to the neonatal ward of Srinagarind Hospital between November 1, 1990 and March 31, 1991 were enrolled in the study. Informed consent was obtained at the time of the patient's admission. The infants who had severe congenital malformations and who had *Klebsiella* colonization on the first culture were excluded from the study. After stratification of the patients by place of birth and birth weight, they were randomly assigned according to block size six to the gloves group, in which all care was given by personnel wearing disposable sterile latex gloves or to a control group, in which care was given by personnel who did not use gloves except when sterile technique was required (Fig. 1). During the period of study, sterile gloves were provided adequately by hospital central supply.

Microbiologic Surveillance

Surveillance cultures were obtained from all pa-

tients within 24 hours of admission to the ward, on day 7 after admission and weekly thereafter until the patients were discharged, or the last day of admission if they left the ward before 7 days. Specimens were obtained from patients' nares, endotracheal tubes (for the one who needed endotracheal intubation) and rectums. They were sent to a clinical microbiological laboratory unit for identifying the organisms and testing for antimicrobial susceptibility by the disc diffusion method (11,12). Strains of *Staphylococcus aureus* were considered to be methicillin resistant when the minimal inhibitory concentration was > 16 µg/ml (13).

DEFINITION

Control group - the infants who were cared by personnel who use standard method of hand-washing by using 4 percent chlorhexidine for initial two-minute scrub to the elbows. Immediately before and after handling in each infant, the hands should be washed for 15 seconds.

Gloves group - the infants who were cared by personnel who wear sterile gloves (after standard method of hand-washing) for every patient's contact

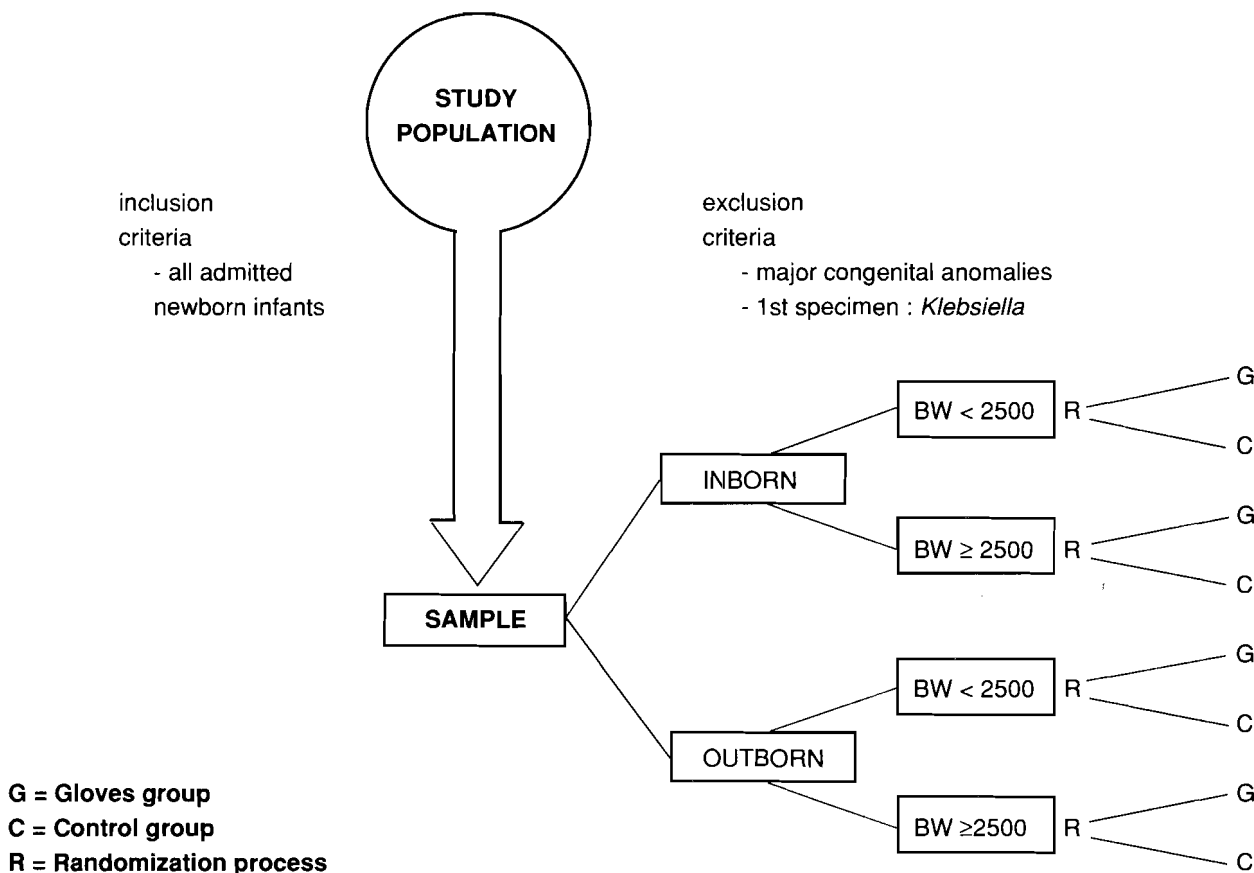


Fig. 1 Study population & Randomization allocation technique.

approximately 6-7 changes per patient per 8-hrs shift.

Infection was considered nosocomial if, at the time of admission to the ward, they were not clinically apparent. The criteria for diagnosis of infection at individual sites follow the definition of the Centers for Disease Control (14) Positive surveillance cultures without signs and symptoms of infection were considered to be colonization.

The following baseline data was collected: birth weight, sex, age, race, gestational age, abnormal maternal and fetal conditions, mode of delivery, Apgar score, diagnosis on admission, date of admission and discharge. Data concerning the risk of infection, including nasogastric intubation, parenteral nutrition, intravenous infusion, urinary catheterization, endotracheal intubation and ventilatory support, were also recorded.

The end point of the study was *Klebsiella* colonization or nosocomial infection or the end of hospital stay.

Monitoring of compliance of using gloves

The patients were observed at least one hour during each 8-hours shift by the research nurse for the number

of physical contacts and for compliance in wearing gloves.

Statistical analysis

The significance of differences between the two groups was determined by using the Student's unpaired t-test for continuous variables and with the chi-square test for categorical variables. Survival data and rank-

Table 1 Baseline characteristics of the patient in the gloves group compare to the control group.

	Gloves gr.	Control gr.
No. of patients	60	42
*Birth weight (gm)	2473 ± 842	2420 ± 785
*Gestational age (wk)	37 ± 3.2	36 ± 3.1
Male : Female	2:1	1.6:1
Birth weight <2,500 gm	32	24
Birth weight <1,500 gm	7	5
Inborn : Outborn	4:1	4.2:1
*Duration of study (day)	6.8 ± 5.8	6.1 ± 4.9

P > 0.05

* mean ± SD

Table 2 Comparison of the risk factors for nosocomial infection in the neonatal ward, Srinagarind Hospital between gloves group and control group.

Factors	Gloves gr.	Control gr.	P value*
	(N = 60)	(N = 42)	
Apgar score at 1 minute < 3	6	10	NS
Resuscitation by endotracheal intubation	8	12	NS
Nasogastric tube feeding	26	17	NS
Intravenous fluid administration	43	29	NS
Intravascular catheterization	9	5	NS
Parenteral nutrition	7	3	NS
Intravenous lipid emulsion	6	2	NS
Urinary catheterization	3	3	NS
Endotracheal intubation	21	16	NS
Mechanical ventilation	17	14	NS
Mean duration of Mechanical ventilation usage (day)	3.9	3.6	NS
Blood components	7	6	NS
Dexamethasone	5	5	NS
Indomethacin	1	1	NS
Antimicrobial therapy	32	17	NS
Intravenous immune globulin	4	3	NS
Respiratory problems on admission	24	18	NS
Surgical problems on admission	10	4	NS
Surgical intervention	11	5	NS

*P > 0.05

Table 3 Comparison of the outcomes due to nosocomial colonization and infection between gloves group and control group.

	Gloves gr. (N = 60)	Control gr. (N = 42)	P value
Nosocomial infection	13 (21.7%) (0.11, 0.32)*	8 (19.07%) (0.01, 0.31)*	NS
Mean onset of infection (day)	7.9	4.7	NS
<i>Klebsiella</i> colonization	30 (50.0%) (0.37, 0.63)*	18 (42.8%) (0.28, 0.58)*	NS
Mean onset of <i>Klebsiella</i> colonization (day)	6.1	8.2	NS
No infection nor colonization	17	16	
No of patients died from infection	3	3	NS

NS = p > 0.05

*95% confidence interval

order statistics were analyzed with the technique described by Kaplan-Meier (15). The P values reported are based on the two-tailed test of significance.

RESULTS

During the 5-months study, 102 newborn infants were randomly assigned to the gloves group (60 infants) and the control group (42 infants). There were no statistically significant differences in birth weight, gestational age, sex, and place of birth in the two groups (Table 1). The exposure to the risk factors for infection in the two groups was also comparable (Table 2). The compliance in wearing gloves was 72.2 per cent.

The overall nosocomial infection rate was 13 (21.7%) of 60 cases for the gloves group, versus 8 (19.07%) of 42 cases for the control group (P>0.05). There was also no statistically significant difference in the two groups in *Klebsiella* colonization rate (P>0.05), as shown in Table 3.

There were 10 septicemic infants (47.6%) among 21 infants with nosocomial infections. The site-specific infections were not significantly different in these two groups (Table 4). Approximately two-thirds of the infections in both groups were confirmed by microbiologic examination; most of the infections were caused by gram negative bacilli (Table 5).

DISCUSSION

Previous studies of protective isolation in newborn infants in which gloves were mostly not used have generally had discouraging results. Combining gowns and gloves in a protective regimen has demonstrated a

Table 4 Types of Nosocomial infection in this study*.

Type	Gloves gr. (N = 60)	Control gr. (N = 42)
** Septicemia	7	3
Pneumonia	2	3
Clinical sepsis	1	1
Necrotizing enterocolitis	0	1
Cellulitis	1	0
Omphalitis	1	0
Conjunctivitis	1	0
Total	13	8

* P > 0.05

**Septicemia + pneumonia 1 case
Septicemia + UTI 1 case**Table 5** Microbiological profile of nosocomial infections in gloves group and control group.

Organism	Gloves gr. (N = 60)	Control gr. (N = 42)
Gram-negative bacilli		
<i>Acinetobacter anitratus</i>	4	1
<i>Escherichia coli</i>	2	1
<i>Klebsiella pneumoniae</i>	1	0
Gram-positive cocci		
Enterococcus	1	1
<i>Staphylococcus epidermidis</i>	1	0
Methicillin-resistant <i>S. aureus</i>	1	0

significant decline in the incidence of nosocomial infections caused by gentamicin-resistant enterobacteriaceae (16) and respiratory syncytial virus (17) Klein et al (4) believed that apart from inclusion of gloves in the

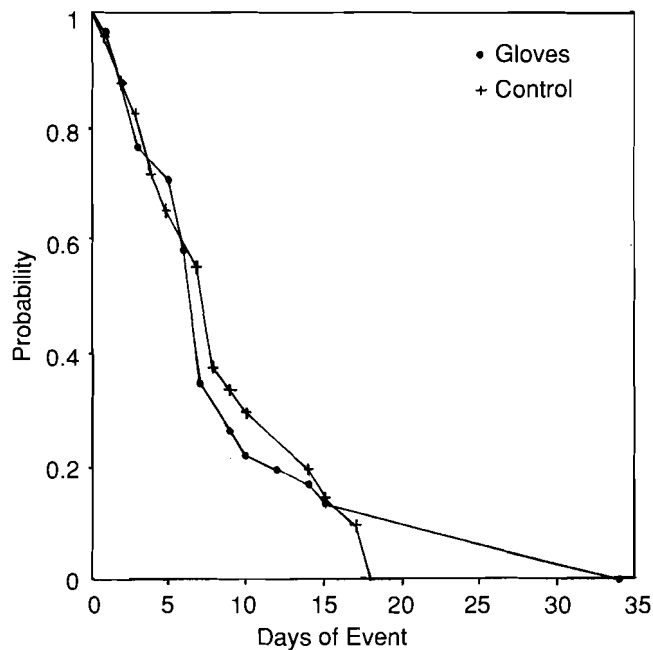


Fig. 2 Probability of patients remaining free of nosocomial infection or *Klebsiella* colonization $P > 0.05$.

isolation regimen, the excellent rate of compliance (93%) by personnel, and possibly the high barrier efficiency of the gowns accounted for the beneficial effect of protective isolation in their study. Leclair et al (17) also showed that increased compliance with glove and gown precautions can reduce the nosocomial transmission of respiratory syncytial virus infection.

In our study, the compliance in wearing gloves was only 72.2 per cent. If we could increase this compliance in wearing gloves, the nosocomial infection rate might decrease.

It is hypothetically possible that when the compliance in wearing gloves was not so high, the infants who were frequently contacted should have developed more nosocomial infections. But we found no statistically significant differences ($P > 0.05$) between the frequency of contact by nursing personnel of the infants with nosocomial infections, *Klebsiella* colonization and no infection.

Klein et al (4) reported a significantly longer infection-free interval in the patients in isolation compared to patients given standard care ($P = 0.04$). Survival analysis in our study, however showed that there was no statistically significant difference in infection free intervals between the gloves group and the control group (Fig. 2).

In this prospective randomized controlled trial, we

found no statistically significant differences in nosocomial infection and *Klebsiella* colonization between the gloves group and the control group ($P > 0.05$). We also found no statistically significant differences between the two groups in infection-free intervals. Handwashing by nursery personnel remains the most effective method for interrupting the spread of potentially pathogenic bacteria (8). Screening cultures to detect the emergence of antibiotic-resistant gram-negative bacilli facilitates containment and guides empiric antibiotic therapy. Surveillance cultures are necessary to detect colonized babies when nosocomial gram-negative bacilli become epidemic in the neonatal ward. Expanded, more innovative education in infection control, especially with handwashing, medical equipments and use of antibiotics, is one of several directions for future research in nosocomial infection control (1).

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