

The influence of hand hygiene prior to insertion of peripheral venous catheters on the incidence of complications

Einfluss der Händehygiene vor dem Legen von peripheren Venenkathetern auf die Häufigkeit von Komplikationen

Abstract

Using two studies of a simple design it has been possible to furnish proof of the influence of hand hygiene prior to insertion of peripheral venous catheters on the incidence of complications. In the first study detailed data were collected anonymously for each patient on the procedure used for catheter insertion or on any complications. Data were collected for around 64% of patients in one hospital. Evaluation of the questionnaires revealed that there was a significant increase in the incidence of complications in line with an increasing duration of the indwelling period of between 24 and 96 hours. The unexpected finding of this evaluation study was that in the case of catheters with an indwelling period of more than two days there were highly significantly lower complication rates in those cases in which hand disinfection was carried out or gloves donned before catheter placement.

The second study, based on the former, documented the cases giving rise to complications.

The proportion of peripheral venous catheters implicated in complications was 24%. Here, too, there was a sharp rise in the risk of complications in line with the duration of the indwelling period. Catheters placed in the OR during the patient's hospital stay showed a significantly lower risk of complications than those inserted on wards, or even in the outpatient department. Conductance of hygienic hand disinfection or the wearing of disposable gloves resulted in significantly lower complication rates compared to normal handwashing or omission of a hand hygiene measure. The most plausible explanation for this positive effect exerted by the wearing of disposable gloves or conductance of hygienic hand disinfection prior to catheter placement is that there was no recontamination during repalpation, as often seen, of the prepared venepuncture site.

Zusammenfassung

Zwei einfach konzipierten Studien ist es gelungen, den Einfluss der Händehygiene vor dem Legen von peripheren Venenkathetern auf die Häufigkeit von Komplikationen zu beweisen. In der ersten Studie wurden pro Patient anonym ausführliche Daten zum Prozedere des Legens bzw. eventueller Komplikationen registriert. Ca. 64% der Patienten eines Krankenhauses wurden berücksichtigt. Die Auswertung der Fragebögen ergab, dass mit einer Liegedauer zwischen 24 und 96 Stunden die Häufigkeit von Komplikationen signifikant zunahm. Das unerwartete Ergebnis der Auswertung war aber, dass es bei Kathetern mit einer Liegedauer von über zwei Tagen hoch signifikant niedrigere Komplikationsraten in jenen Fällen gab, in denen vor dem Legen eine Händedesinfektion durchgeführt oder beim Legen Handschuhe getragen wurden. In der darauf aufbauenden, zweiten Studie wurden Fälle mit Komplikationen dokumentiert. Die Rate von peripheren Venenkathetern, bei

Günther Wewalka¹

1. AGES Institute for Medical Microbiology and Hygiene, Vienna, Austria

denen Komplikationen beobachtet wurden, betrug 24%. Auch hier stieg mit der Liegedauer der Katheter das Risiko von Komplikationen deutlich an. Katheter, die während des Aufenthaltes des Patienten im OP gelegt worden waren, hatten ein signifikant geringeres Risiko von Komplikationen als solche, die auf Stationen oder gar in der Ambulanz gelegt wurden waren. Das Durchführen einer hygienischen Händedesinfektion oder das Anziehen von Einweghandschuhen führte im Vergleich zum normalen Waschen der Hände oder den Verzicht auf eine händehygienische Maßnahme zu signifikant niedrigeren Komplikationsraten. Die wahrscheinlichste Erklärung für den positiven Effekt der Einweghandschuhe oder der hygienischen Händedesinfektion vor dem Kathetersetzen ist, dass die bereits desinfizierte vorgesehene Einstichstelle bei oftmals vorkommender neuerlicher Palpation der Vene nicht rekontaminiert wird.

Text

Already back in 1850, Ignatz Semmelweis [1] was able to demonstrate in a spectacular manner that hand hygiene could prevent infections, but since then very few studies have been able to attest to the importance of hand hygiene in everyday practice. It is therefore all the more remarkable that in two studies of simple design [2], [3] it has been possible to furnish proof of the influence of hand hygiene prior to insertion of peripheral venous catheters on the incidence of complications. Both studies were conducted as practical exercises within the framework of the training course for infection control nurses in Austria.

Using a questionnaire, Hans Hirschmann had the persons placing peripheral venous catheters record anonymously the following data: patient data, data and time of insertion, localization of insertion site, professional status of person placing the catheter (physician, nurse, medical student), place catheter fitted (OR, ward, outpatient department), type of skin antiseptic (exposure time to an alcohol-based skin antiseptic <15 s or >15 s), type of hand hygiene practiced before placement of the catheter (no hygienic measure, handwashing, hygienic hand disinfection with an alcohol-based product, donning of non-sterile disposable gloves) and, finally, the reason for catheter placement. On removing the peripheral venous catheter the person doing so now entered the following information on the same questionnaire: date and time of removal, reason for removal as well as complications (redness, swelling, pain, fever of unknown origin, pus at insertion site, other reason).

For the first study [2], 1148 questionnaires were completed in an Austrian hospital. On the basis of the average consumption of peripheral venous catheters (approx. 600 per week) a data registration quota of approx. 64% can be assumed. Each patient received on average 1.4 peripheral venous catheters during their hospital stay, calculated on the basis of the number of patients and consumption of venous catheters.

Evaluation of the questionnaires revealed that there was a sharp increase in the incidence of complications in line

with an increasing duration of the indwelling period of between 24 and 96 hours.

The unexpected but conspicuous finding of this study was that in the case of catheters with an indwelling period of more than two days there were highly significantly lower complication rates in those cases in which hand disinfection was carried out or gloves donned before catheter placement. Conversely, there was a higher rate of complications in those cases in which the hands were washed or hand hygiene measures dispensed without before placement.

The findings of the first study gave rise, under the aegis of EURIDIKI (European Interdisciplinary Committee for Infection Prophylaxis), to the initiation of a further analogous study [3], so as to verify these remarkable findings regarding the influence exerted by hand hygiene prior to insertion of peripheral venous catheters on the incidence of complications. This study was also carried out as part of the training course for infection control nurses in parallel at three Austrian hospitals, with the aforementioned questionnaires being completed and evaluated for a total of 1132 peripheral venous catheters.

Overall, 379 separate complications were recorded, with more than one complication being seen per catheter (Table 1). The proportion of peripheral venous catheters implicated in complications was 24%.

Table 1: Incidence of separate complications in the case of 1132 peripheral venous catheters

Type of complication	N	%
Redness	172	15.1
Swelling	82	7.3
Pain	123	10.8
Pus at insertion site	0	0.0
Fever of unknown origin	2	0.2

Using uni- and multivariate analyses, various factors implicated in the complication rates were checked for significance (Table 2).

There was a sharp rise in the relative risk of complications the longer the catheter was in place. For the period

Table 2: Complication rates (CR) and findings of uni- (UVA) and multivariate analyses (MVA) expressed as the relative risk (RR) as well as 95% confidence interval (CI) for various factors

Factor	N	CR (%)	UVA		MVA	
			RR	95% CI	RR	95% CI
Indwelling period						
0-24 h	711 ⁺	20.7	1.00		1.00	
25-48 h	207	26.1	1.35	0.95-1.94	1.26	0.86-1.83
49-72 h	131	31.3	1.75**	1.16-2.64	1.53**	1.00-2.36
>72 h	83	37.4	2.29**	1.42-3.70	2.06**	1.24-3.45
Place catheter fitted						
Ward	902 ⁺	26.2	1.00		1,00	
Outpatient dept.	50	36.0	1.59	0.88-2.88	1.41	0.75-2.64
OR	180	10.6	0.33**	0.20-0.55	0.42**	0.23-0.77
Patient's age						
Up to 70 years	835 ⁺	22.4	1.00		1.00	
Over 70 years	297	29.0	1.38*	1.03-1.85	1.14	0.83-1.57
Hand hygiene						
No hygienic measure	310 ⁺	30.3	1.00		1.00	
Handwashing	101	32.7	1.11	0.69-1.80	1.12	0.68-1.85
Gloves	183	18.0	0.51**	0,32-0.79	0.52**	0.33-0.85
Hand disinfection	538	21.0	0.61**	0.44-0.84	0.65*	0.47-0.91

* p>0.05; ** p>0.01; ⁺ Reference category

between 49-72 h and more than 72 h, the complication rates were significantly higher than those in the 0-24 h period. This finding lends credence to the demand that the duration of the indwelling period be limited in general to 2-3 days.

Catheters placed in the OR during the patient's hospital stay showed a significantly lower risk of complications than those inserted on wards, or even in the outpatient department. The likely explanation for this is that already when entering the OR sluice, hand hygiene measures are taken that have a positive effect on the complication rates.

Univariate analysis showed a significantly higher relative risk for venous catheter complications in patients older than 70 years compared with younger patients, but this was not the case for the multivariate analysis. Is all probability this was due to the fact that in the case of patients younger than 70 years, only in 5% of cases did the duration of the catheter indwelling period exceed 72 h, whereas this was longer than 72 h for 13.8% of the catheters in the case of patients older than 70 years.

As regards the role of hand hygienic measures prior to catheter insertion, it was possible to fully confirm the results of the first study. Conductance of hygienic hand disinfection or donning of disposable gloves, as compared with normal hand washing or omission of hand hygienic measures, led to markedly lower complication rates,

which proved to be significant in the uni- as well as the multivariate analysis. The most plausible explanation for this positive effect exerted by the wearing of disposable gloves or conductance of hygienic hand disinfection prior to catheter placement is that there was no recontamination during repalpation, as often seen, of the prepared venepuncture site. The study reported here was one of the chief reasons why the guideline drafted by the Robert Koch Institute (RKI) "Prevention of Vascular-Associated Infections" [4] assigned hygienic hand disinfection prior to insertion of peripheral venous catheters to Category I A (recommendation based on well-designed experimental or epidemiological studies).

Curriculum Vitae

a.o. Univ. Prof. Dr. med. habil. Günther Wewalka

Figure 1



Figure 1: Günther Wewalka

Specialist for Hygiene; Head of Austrian Agency for Health and Nutrition Safety, Institute for Microbiology and Hygiene.

Günther Wewalka studied Medicine at the University of Vienna and received his doctoral degree there in 1971. First he became assistant doctor at the Institute for Hygiene, and then changed to the professorship for Chemotherapy of the 1. Medicinal University Clinic until he went back to the Institute of Hygiene where he habilitated in 1981.

In 1987 he was appointed Head of the federal bacteriological-serological Analysis Institute (today: Austrian Agency for Health and Nutrition Safety, Institute for Medicinal Microbiology and Hygiene) in Vienna. Apart from this he is hospital hygiene consultant for the city of Vienna, as an internationally respected hospital hygienist he is advisor for several hospitals, also a board member of the Austrian Society for Hygiene, Microbiology and Preventive Medicine (ÖGHMP – from 2002-2004 chairman thereof),

member of the task force „Influenza Pandemieplan“, member of the National Committee for the Eradication of Polio and much more.

His special interest is in Legionella. The European task force on Legionella-infections (EWGLI) as well as all national associations and committees are highly benefiting from his special knowledge in this area.

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Corresponding author:

Univ. Prof. Dr. Günther Wewalka
AGES Institut für medizinische Mikrobiologie und Hygiene,
Währinger Straße 25a, A-1096 Wien
guenther.wewalka@ages.at

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