3M curos™
Disinfecting Caps

The dirty truth about IV access points.

The evidence is clear:

IV access points are invisibly dirty

Study after study has confirmed what many have suspected – all IV access points provide a portal of entry for contaminants to enter the bloodstream.

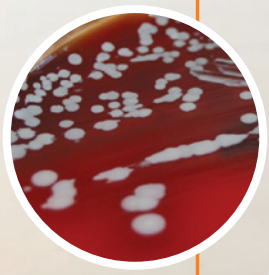
Every IV access point on a patient presents potential for development of a Catheter Related Blood Stream Infections (CRBSI). The often devastating effects of CRBSI have prompted countless clinical studies whose results have gone on to help establish 'best practice guidelines for the care and maintenance of a patients' central line.

On the following pages, you will find our summary of some of the most compelling clinical evidence available detailing contamination risks at every IV access point: needleless connectors, male luers, and open female luers (such as stopcocks and catheter hubs).

Are you ready to see the dirty truth?

Are all of your IV access points protected?

This is a picture of a culture taken from an unprotected IV access point. Unprotected IV access points can touch floors, armpits, bed linens and other unsterile surfaces, adding to their bioburden.[1]



1 Kaler, W. Making it easy for nurses to reduce the risk of CLABSI. *Patient Safety & Quality Healthcare*. 2014; 11(6), 46–49.

Intraluminal contamination:

All IV access points are potential portals of entry for contamination[2]

33–45% of needleless connector hubs
are contaminated in normal patient use[3]

An ICU study found that **37% of male luers**
become contaminated[4]

As many as **50% of catheter hubs**
may be colonised in standard practice[5]

Use of 3-way **stopcocks** is a signicant, independent
risk factor for catheter-related bloodstream infections (CRBSI)
(OR 11.98 [95% CI, 1.26-113.51]; p = 0.030)[6]

2 The Joint Commission. *Preventing central line–associated bloodstream infections: A global challenge, a global perspective.* Oak Brook, IL: Joint Commission Resources; Mat 12, 2012. https://www.jointcommission.org/assets/1/18/CLABSI_Monograph.pdf

3 Moureau NL, Flynn J. Disinfection of needleless connector hubs: Clinical evidence systematic review. *Nurs Res Pract.* 2015; 1–20.

4 Lopansri BK, Nicolescu I, Tomich A, Belmares J, Parada J, Schreckenberger P. Microbial colonization of needleless intravenous connectors and the male luer end of IV administration sets: Does the partner matter? Presented at: Society for Healthcare Epideiology of America Scientific Meeting; April 2011; Dallas, TX.

5 Marschall J, Mermel LA, Fakih M, et al. Strategies to prevent central line-associated bloodstream infections in acute care hospitals: 2014 update. *Infect Control Hosp Epidemiol.* 2014; 35(7): 753–771.

6 Yebenes JC, Vidaur L, Serra-Prat M, et al. Prevention of catheter-related bloodstream infection in critically ill patients using a disinfectable, needle-free connector: A randomized controlled trial. *Am J Infect Control.* 2004; 32(5): 291–295.

Needleless connectors

N. Morneau and J. Flynn, "Disinfection of Needleless Connector Hubs: Clinical Evidence Systematic Review," *Nursing Research and Practice*, vol. 2015, 5, Article ID 796762, 20 pages

Overview: *This systematic review evaluated 140 studies and 34 abstracts on needleless connector disinfection practices, the impact of hub contamination on infection, and measures of education and compliance.*

- When a CLABSI occurs well after the 96-hour mark, contamination through the needleless connector is likely the culprit.
- A single omission of scrubbing the hub prior to access permits bacterial entry, attachment and biofilm formation that allow the bacteria to strengthen prior to release into the bloodstream.
- Conclusion: Passive disinfection caps reduce guess work, provide clinicians with a point-of-use solution and reduce contamination.

https://www.hindawi.com/journals/nrp/2015/796762/

The needleless connector is likely the culprit of CLABSI development after the

96-hour mark

J. Lee, "Disinfection cap makes critical difference in central line bundle for reducing CLABSIs," in Proceedings of the APIC Annual Conference, vol. 39, p. E64, Fort Lauderdale, Fla, USA, 2013

Overview: *Auditing compliance with the scrub the hub disinfecting method is difficult because it requires someone to follow the nurse on rounds. Compliance with disinfecting cap use is more easily verified because it is accomplished via a quick visual check: the cap is either there or it is not. To reduce CLABSI risk created by noncompliance and technique variation from scrubbing the hub, a trial use of disinfecting caps for all central line hubs was conducted in a hospital ICU.*

- An observational study conducted in 2009 showed less than 10% compliance with the scrub the hub disinfection protocol.
- After implementation of disinfecting caps at the beginning of 2010, CLABSI rates dropped from 1.16 to 0.7 per 1,000 catheter days.
- Following the study and disinfecting cap implementation, a survey showed that 87% of nurses chose using disinfecting caps over the scrub the hub method.

http://www.sciencedirect.com/science/article/pii/S0196655311004883?showall%3Dtrue%26via%3Dihub

Less than 10%
of compliance with the scrub the hub disinfection protocol

M. B. Salzman and L. G. Rubin, "Relevance of the catheter hub as a portal for microorganisms causing catheter-related bloodstream infections," *Nutrition*, vol. 13, no. 4, supplement, pp. 15s–17s, 1997

Overview: *To ascertain the natural history of catheter hub contamination and its relation to catheter-related sepsis, a prospective study was completed where the catheter hub was cultured three times per week in all neonates who had a long-term central venous catheter in a neonatal intensive care unit.*

- 71% of catheter-related infections are linked to a catheter hub contamination.
- Of the 900 hub cultures taken, 45% yielded the following 457 isolates: CONS (268), *Staphylococcus aureus* (11), *enterococci* (35), *Propionibacterium species* (51), other gram-positive *isolates* (57), gram-negative *bacilli* (23) and *yeasts* (12).
- During the study, contamination of a hub with *Serratia marcescens* was documented 2 days before the onset of clinical sepsis. In an otherwise well and growing premature infant, this infection led rapidly to septic shock and death.

http://www.sciencedirect.com/science/article/pii/S0899900797002177

71%
of catheter-related infections are linked to a catheter hub contamination

E. Perez, M. Williams, J. T. Jacob et al., "Microbial biofilms on needleless connectors for central venous catheters: comparison of standard and silver-coated devices collected from patients in an acute care hospital," *Journal of Clinical Microbiology*, vol. 52, no. 3, pp. 823–831, 2014.

Overview: *Standard and silver-coated needleless connectors were collected from central venous catheters (CVC) used with patients hospitalised in the intensive care unit of a university hospital. The collected needleless connectors were analysed for microorganisms.*

- More than 90% of the standard and silver-coated needleless connectors were colonised by viable microorganisms – as measured by a total viable microbial cell count assay.
- Approximately 50% of the standard and silver-coated needleless connectors contained organisms that were recovered by plate counting.

http://jcm.asm.org/content/52/3/823.full

More than 90%
of standard and silver-coated needleless connectors were colonised

Help prevent contamination

Disinfect and protect your needleless connectors with 3M™ Curos™ Disinfecting Caps for Needleless Connectors.

Male leurs

Hadaway, L., "Intermittent Intravenous Administration Sets: Survey of Current Practices," *JAVA*, vol.12, no 3, pp. 143-147, 2007

Overview: *Lynn Hadaway Associates, Inc. conducted a survey of nurses interested in infusion therapy, infection control, and staff development. The survey was open for a three-week period, with 361 nurses responding.*

- 52% of respondents reported that their organisational policies and procedures did not include instructions for the management of the male luer end of the administration set.
- 43.6% of respondents indicated that yes, there is a need to clean the tip of the male luer end of an IV set with a disinfecting agent, whereas 56.4% answered no.
- 49% indicated that the male luer end of the set should be routinely cleaned with each connection and disconnection to the catheter.
- 17% of respondents stated that cleaning was only required during accidental contamination, such as touching the tubing on clothing or linens, or dropping it on the floor.
- 68.1% of respondents said a sterile tip cap was used on the male luer end of the IV set when disconnected from the needleless connector, whereas 31.2% reported using other sterile needleless components such as a blunt plastic cannula.
- Over half (52%) of respondents said that their facility's policies and procedures did not include instructions for the management of the male luer.
- More than 90% of respondents acknowledged that they have observed IV sets used to administer intermittent medications left disconnected and uncapped.

http://www.sciencedirect.com/science/article/pii/S1552885507703318

Nearly 60%
of respondents indicated that they were unaware of a policy and/or unaware of the need to disinfect male luers

Lopansri, et al., "Microbial Colonisation of Needleless Intravenous Connectors and the Male Luer End of IV Administration Sets: Does the Partner Matter?" SHEA 2011 Annual Scientific Meeting

Overview: *This study was completed to determine colonisation and cross contamination rates of needleless connectors and male luers from patients admitted to 5 different intensive care units at Loyola University Medical Center (LUMC). It was determined that needleless connectors and male luers serve as possible reservoirs for CLABSIs.*

- 279 devices (212 needleless connectors and 67 male luers) from 78 patients were tested. 52 needleless connectors (25%) and 25 male luers (37%) cultured positive.
- Of the positively-cultured male luers, 8 patients fulfilled criteria for CLABSI, 5 had clinically insignificant positive blood cultures and 6 had bacteremia from another source.
- Colonisation of the male luers may have greater significance due to its potential to introduce microorganisms into the IV fluid tract, which cannot be disinfected using the scrub the hub method.
- Both needleless connectors and the male luers of IV administration sets are colonised at similar rates by similar organisms and serve as potential reservoirs for CLABSI or clinically significant positive blood cultures.
- Molecular data demonstrated cross-contamination of the male luer, the needleless connector, as well as the bloodstream.

https://shea.confex.com/shea/2011/webprogram/Paper4539.html

37%
of male luers cultured positive for contamination

Akridge, J. "Infection prevention efforts as varied as infections," *Healthcare Purchasing News*, vol 34, no. 7 pp. 44

Overview: *A description of IV connectors in current use, how they differ in design and function, the potential complications associated with various models and practice. Also addressed are the nursing interventions that can reduce the risk of these complications.*

- Based on preliminary clinical data, the male luer has proven even more contaminated than the needleless injection site.
- There are many ways the male luer can become contaminated – such as connecting it to a contaminated needleless injection site, airborne microbes, the luer touching the IV pole, the bed, the patient's skin, or even inadvertent contamination from the nurse.

The male luer has proven **even more contaminated** than the needleless injection site

Hadaway, L. Med, RNC, CRNI, "Needleless Connectors for IV Catheters," *AJN*, vol. 112, no. 11, 2012

Overview: *The author describes the connectors in current use, how they differ in design and function, the potential complications associated with various models and practices, and the nursing interventions that can reduce the risk of these complications.*

- Due to the design and configuration of the surface of a needleless connector, ease of connecting and cleaning may be compromised. It's flat surface creates a challenge when connecting to the IV set or syringe as the male luer glides around the surface prior to mating, increasing the risk of contamination.
- A variety of unsupported practices to protect the male luer are still in practice, including: leaving the luer completely exposed; covering it with a foil package that previously held an alcohol wipe; covering it with the cap just removed from a flush syringe; and connecting it to the needleless connector higher on the same set – a practice referred to as 'looping'.

http://hadawayassociates.com/uploads/3/5/4/4/35447364/needleless_connectors_for_iv_catheters_23.pdf

A variety of **unsupported practices** are still in use for protecting the male luer from contamination

Delahanty K.M., Myers III, F.E. "I.V. infection control survey report," *Nursing2009*, Issue 12, December 2009, Pages 24-30

Overview: *Nursing2009 surveyed nearly 600 nurses to see how well they know and apply evidence-based guidelines in practice; specifically, as it relates to preventing peripheral and central line-associated bloodstream infections.*

- When asked what is done with intermittent IV tubing while it is not in use, 82% of respondents stated that they placed a new dead-end cap on the end of the male luer.
- 10% of respondents stated that they attached the male luer end to an injection port on the same tubing, a practice often referred to as 'looping'.

http://journals.lww.com/nursing/Citation/2009/12000/Nursing2009__I_V__infection_control_survey_report.11.aspx

10% of respondents stated that they looped the male luer into the needleless connector

Infusion Nurses Society, Infusion Nursing: an evidence-based approach, pp. 404-406

- "If using a luer-access needleless system, the male luer end of the administration set must be protected with a new dead-end cap. The action of inserting the male luer tip of the administration set into an injection port higher on the same set, referred to as "looping", is not considered appropriate. Any organisms present on the male luer end would be spread into the entire administration set as well."
- "Guidelines from the Centers for Disease Control and Prevention state that only sterile devices should be used to access injection ports.[7] Extending the use of primary intermittent sets can increase the risk of contamination of the male luer end. This contaminated set is then reconnected to a needleless connector, consequently increasing the potential for catheter-associated bloodstream infection."

https://www.ins1.org/Store/ProductDetails.aspx?productId=113276

The action of **looping** is not considered appropriate

Help prevent contamination

Disinfect and protect your male luers with
3M™ Curos Tips™ Disinfecting Caps for Male Luers

Open female leurs

Hadaway, L., "Stopcocks for Infusion Therapy: Evidence and Experience," (2018): *Journal of Infusion Nursing*. 41(1), p.24–34.

Overview: *Over the past two decades, a growing number of studies have highlighted concern over the risk of intraluminal contamination from open female luers (stopcocks). Hadaway's extensive literature review looks at the body of published evidence surrounding open female luer practices and provides a thorough survey of clinician practices that summarises an ample survey of current clinician practices.*

- In another study, "patients were followed for 30 post-operative days to identify hospital-acquired infections. They identified 5 patients with stopcock contamination who developed nosocomial pneumonia, wound and BSIs. Two patients died from their infection."[8]
- In a small pilot study, 70 stopcocks (that included manifolds) were cultured. The findings showed that 9 of the manifolds (38%) had growth in at least 1 stopcock and 12 of the individual stopcocks (17%) had growth. Based on those findings, practice changes were initiated, including the use of disinfection caps.[9]
- In a survey of 315 clinicians, most of whom were nurses, 12% of the respondents believed that disinfection of a stopcock is not possible because it is an open lumen.
- Studies conducted in ORs indicate that IV set contamination has an influence on all infection rates during the inpatient period.
- Almost 60% of clinicians surveyed responded that they have found stopcock lumens left open in practice.

https://journals.lww.com/journalofinfusionnursing/Fulltext/2018/01000/Stopcocks_for_Infusion_Therapy__Evidence_and.3.aspx

Almost 60% of clinicians surveyed responded that they have found **stopcock**

lumens left open

in practice

A.L. Casey, "A prospective clinical trial to evaluate the microbial barrier of a needleless connector," *Journal of Hospital Infection*, vol. 65, no 3, 2007.

Overview: *This prospective clinical study compared contamination rates of internal stopcock luers with standard caps versus those with attached needleless connectors in post-operative cardiothoracic surgery patients. The internal surfaces of stopcocks with standard caps were found to be contaminated in greater frequency (10%) than those with needleless connectors attached (0.5%).*

- The internal surfaces of 20 of 200 (10%) three-way stopcock luers with standard caps were contaminated whereas only 1 of 193 (0.5%) luers with needleless connector attached was contaminated.
- These results demonstrate that the use of the needleless connector device along with a dedicated disinfection regimen reduces the internal microbial contamination rate of CVC – Central Venus Catheter luers compared with standard caps.
- Of the intravenous connections activated once, there were significantly more luers contaminated in the three-way stopcock group than the needleless connector group.

http://www.sciencedirect.com/science/article/pii/S0195670106005123?showall%3Dtrue%26via%3Dihub

10%

of the three-way stopcock luers with standard caps were contaminated

7 O'Grady NP. et al. Guidelines for the Prevention of Intravascular Catheter-Related Infections. CDC, 2002 Report.

8 Loftus RW, Koff MD, Burchman CC, et al. Transmission of pathogenic bacterial organisms in the anesthesia work area. *Anesthesiology*. 2008;109(3):399–407.

9 Mermel LA, Bert A, Chapin KC, LeBlanc L. Intraoperative stopcock and manifold colonization of newly inserted peripheral intravenous catheters. *Infect Control Hosp Epidemiol*. 2014;35(9):1187–1189.

Loftus, R. W., et al. "Transmission of Pathogenic Bacterial Organisms in the anesthesia work area," *Anesthesiology*, vol. 109, pp. 399–407, 2008.

Overview: *In a multicenter study, stopcock transmission events were observed in 274 operating rooms. In each operating room, the focus was on the first and second cases of the day to enable identification of within-case and between-case transmission events.*

- Stopcock contamination was detected in 23% of cases (126 out of 548) and was significantly associated with increased mortality.
- There were 14 between-case and 30 within-case stopcock transmission events confirmed.
- The hands of the provider were confirmed as vectors for transmission between the contaminated environment and contaminated stopcock sets in 27% (12 of 44) of between-case and within-case stopcock transmission events.
- Findings suggest that stopcock contamination occurs independently of factors associated with the severity of patient illness and/or procedural complexity.

Stopcock contamination was associated with the second case of the day.

http://journals.lww.com/anesthesia-analgesia/fulltext/2012/06000/Multiple_Reservoirs_Contribute_to_Intraoperative.15.aspx

Contamination of stopcocks was detected in

23% of cases

Cole, D., et. al. "Leaving More Than Your Fingerprint on the Intravenous Line: A Prospective Study on Propofol Anesthesia and the Implications of Stopcock Contamination." *Anesthesia & Analgesia*, vol. 120, no. 4, pp. 861–867, 2015.

Overview: *IV tubing sets were gathered at the time of patient discharge from same-day ambulatory procedures performed with and without propofol anesthesia. The stopcocks from the tubing sets were tested for contamination.*

- Positive bacterial counts were recovered from 17.3% of propofol anesthesia stopcocks.
- Positive bacterial counts were recovered from 18.6% of non-propofol stopcocks.
- There was a 100-fold increase in bacterial number in contaminated stopcock dead spaces at 48 hours after propofol anesthesia.
- Additional analysis of intralipids found that bacterial growth was at levels of clinical concern within the first 12 hours. Organisms included *Pseudomonas*, *Acinetobacter*, *Staphylococcus* and *Micrococcus.*
- Regardless of degree of acute care and length of procedure, the incidence of contamination was similar between propofol anesthesia and non-propofol anesthesia stopcocks.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3833883/

There was a

100-fold increase

in bacterial number in contaminated stopcock dead spaces

Mueller-Premru, M. et. al., "Use of semi-quantitative and quantitative culture methods and typing for studying the epidemiology of central venous catheter related infections in neonates on parenteral nutrition." ***J. Med. Microbiology*****, vol. 48, pp. 451–460, 1999**

Overview: *Forty-nine neonates were included in the study where stopcocks and other potential sites of bacterial access were cultured and divided into two groups according to stopcock contamination. The impact of contaminated stopcocks on central venous catheter tip infection and catheter-related sepsis was studied.*

- Overall, the stopcocks were contaminated in 36% of the neonates and the catheter tips were colonised with bacteria of the same species as those from the stopcocks.
- In group A specifically, 83% of the infants were colonised with bacteria of the same species as found in the stopcock.
- More frequently, the bacterial species found on the catheter tips corresponded to those found in the stopcocks than to those found on the skin.
- The parenteral fluid was contaminated in almost half the patients with contaminated stopcocks, probably as a result of retrograde flow.
- The results suggest that the catheter stopcock is more likely the origin of central venous catheter tip infection and catheter-related sepsis than the patient's skin.
- The incidence of stopcock contamination, central venous catheter tip infection and sepsis decreased when enhanced infection control measures were implemented.

http://www.microbiologyresearch.org/docserver/fulltext/jmm/48/5/medmicro-48-5-451.pdf?expires=1520370486&id=id&accname=guest&checksum=4210755FF68B97A0273F3DF3D5C5D2AD

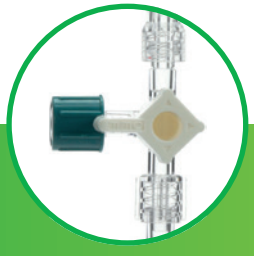
83%
of patients
in group A had a catheter tip and stopcock colonised with the same bacteria

All patients, all access points, all the time.

According to the 2021 Infusion Nurses Society Infusion Therapy Standards of Practice, "Passive disinfection with caps containing 70% isopropyl alcohol, were associated with lower rates of CABSI."[7]

Use the entire family of Curos disinfecting caps to reduce risks across all intraluminal access points.

3M™ Curos™ Disinfecting Cap for Needleless Connectors



3M™ Curos™ Stopper Disinfecting Cap for Open Female Luers

Also available in red cap colour

3M™ Curos™ Disinfecting Cap for Tego® Hemodialysis Connectors

3M™ Curos Tips™ Disinfecting Cap for Male Luers

7 Gorski, L. A., Hadaway, L., Hagle, M.E., Broadhurst, D., Clare, S., Kleidon, T., Meyer, B.M., Nickel, B., Rowley, S., Sharpe, E., Alexander, M. (2021). *Journal of Infusion Nursing*, 44(suppl 1):S1–S224.

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