



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

Utilizzando tecniche statistiche di analisi temporale degli eventi e di regressione multivariata, i ricercatori di questo ampio studio multicentrico hanno dimostrato un decremento statisticamente significativo delle CRBSI del 66%, approssimativamente 18 mesi dopo l'inizio degli interventi preventivi [69], nonché una loro riduzione protratta nel tempo [369]. A seconda dell'area identificata come oggetto di potenziale miglioramento della performance clinica, ogni istituzione dovrebbe preoccuparsi di definire strategie specifiche e soprattutto una misura oggettiva di determinati parametri su cui basare il giudizio di efficacia (es.: incidenza di infezione da CVC, percentuali di linee centrali posizionate adottando, in maniera documentata, tutti o singoli elementi del *bundle*).

Infine, a parte la tecnica di impianto, l'enfasi sull'assistenza e la gestione del catetere venoso centrale dovrebbe essere punto focale per il miglioramento della *performance* e garanzia di qualità in tutti i progetti. Uno studio clinico ha investigato la pratica e la conoscenza da parte dello staff riguardo alla gestione post-impianto dei CVC e ha potuto identificare determinati aspetti della gestione del catetere in cui sussistono ampi margini di miglioramento [370]. Lo studio ha preso in considerazione 151 CVC in 106 pazienti per un totale di 721 giorni-catetere. In tutto, sono stati identificati 323 comportamenti non appropriati durante la gestione, che hanno comportato un tasso di complicanze del 44.8%, con significativa differenza tra le unità di terapia intensiva ed i reparti non intensivi. I più frequenti errori di gestione del CVC furono il mantenimento *in situ* di medicazioni non integre e la manipolazione scorretta dei cappucci (158 e 156 episodi per 1000 giorni-catetere rispettivamente). Gli interventi volti ad aumentare la qualità dell'assistenza dovrebbero avere come obiettivo la ricerca di strategie che rendano più facile la applicazione pratica delle raccomandazioni basate sulle prove di efficacia.

Bibliografia

1. Mermel LA. Prevention of intravascular catheter-related infections. (Erratum: Ann Intern Med 133: 395, 2000). Ann Intern Med 2000; 132:391-402.
2. Dimick JB, Pelz RK, Consunji R, Swoboda SM, Hendrix CW, Lipsett PA. Increased resource use associated with catheter-related bloodstream infection in the surgical intensive care unit. Arch Surg 2001; 136:229-34.
3. Warren DK, Quadir WW, Hollenbeak CS, Elward AM, Cox MI, Fraser VJ. Attributable cost of catheter-associated bloodstream infections among intensive care patients in a nonteaching hospital. Crit Care Med 2006; 34:2084-9.
4. Blot SI, Depuydt P, Annemans L, et al. Clinical and economic outcomes in critically ill patients with nosocomial catheter-related bloodstream infections. Clin Infect Dis 2005; 41:1591-8.
5. Renaud B, Brun-Buisson C. Outcomes of primary and catheter-related bacteremia. A cohort and case-control study in critically ill patients. Am J Respir Crit Care Med 2001; 163:1584-90.
6. Maki DG, Kluger DM, Crnich CI. The risk of bloodstream infection in adults with different intravascular devices: a systematic review of 200 published prospective studies. Mayo Clin Proc 2006; 81:1159-71.

Rev. n° 0 del 01.06.2014

5) Informare il team clinico degli episodi di CRBSI e della loro incidenza complessiva;

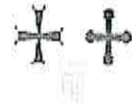
7. Yoo S, Ha M, Choi D, Pai H. Effectiveness of surveillance of central catheter-related bloodstream infection in an ICU in Korea. *Infect Control Hosp Epidemiol* 2001; 22:433-6.
8. Warren DK, Zack JE, Cox MJ, Cohen MM, Fraser VJ. An educational intervention to prevent catheter-associated bloodstream infections in a non-teaching community medical center. *Crit Care Med* 2003; 31:1959-63.
9. Warren DK, Zack JE, Mayfield JL, et al. The effect of an education program on the incidence of central venous catheter-associated bloodstream infection in a medical ICU. *Chest* 2004; 126:1612-8.
10. Warren DK, Cosgrove SE, Diekema DJ, et al. A multicenter intervention to prevent catheter-associated bloodstream infections. *Infect Control Hosp Epidemiol* 2006; 27:662-9.
11. Higuera F, Rosenthal VD, Duarte P, Ruiz J, Franco G, Safdar N. The effect of process control on the incidence of central venous catheter-associated bloodstream infections and mortality in intensive care units in Mexico. *Crit Care Med* 2005; 33:2022-7.
12. Coopersmith CM, Rebmann TL, Zack JE, et al. Effect of an education program on decreasing catheter-related bloodstream infections in the surgical intensive care unit. *Crit Care Med* 2002; 30:59-64.
13. Coopersmith CM, Zack JE, Ward MR, et al. The impact of bedside behavior on catheter-related bacteremia in the intensive care unit. *Arch Surg* 2004; 139:131-6.
14. Sherertz RJ, Ely EW, Westbrook DM, et al. Education of physicians-in-training can decrease the risk for vascular catheter infection. *Ann Intern Med* 2000; 132:641-8.
15. Eggimann P, Harbarth S, Constantin MN, Touveneau S, Chevolet JC, Pittet D. Impact of a prevention strategy targeted at vascular-access care on incidence of infections acquired in intensive care. *Lancet* 2000; 355:1864-8.
16. Nehme AE. Nutritional support of the hospitalized patient. The team concept. *JAMA* 1980; 243:1906-8.
17. Soifer NE, Borzak S, Edlin BR, Weinstein RA. Prevention of peripheral venous catheter complications with an intravenous therapy team: a randomized controlled trial. *Arch Intern Med* 1998; 158:473-7.
18. Tomford JW, Hershey CO, McLaren CE, Porter DK, Cohen DI. Intravenous therapy team and peripheral venous catheter-associated complications. A prospective controlled study. *Arch Intern Med* 1984; 144:1191-4.
19. Scalley RD, Van CS, Cochran RS. The impact of an i.v. team on the occurrence of intravenous-related phlebitis. A 30-month study. *J Intraven Nurs* 1992; 15:100-9.
20. Palefski SS, Stoddard GJ. The infusion nurse and patient complication rates of peripheral-short catheters. A prospective evaluation. *J Intraven Nurs* 2001; 24:113-23.
21. Miller JM, Goetz AM, Squier C, Muder RR. Reduction in nosocomial intravenous device-related bacteremias after institution of an intravenous therapy team. *J Intraven Nurs* 1996; 19:103-6.

Rev. n° 0 del 01.06.2014



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

22. Hunter MR. Development of a Vascular Access Team in an acute care setting. *J Infus Nurs* 2003; 26:86-91.
23. Hawes ML. A proactive approach to combating venous depletion in the hospital setting. *J Infus Nurs* 2007; 30:33-44.
24. Brunelle D. Impact of a dedicated infusion therapy team on the reduction of catheter-related nosocomial infections. *J Infus Nurs* 2003; 26:362-6.
25. Bosma TL, Jewesson PI. An infusion program resource nurse consult service: our experience in a major Canadian teaching hospital. *J Infus Nurs* 2002; 25:310-5.
26. Pierce CA, Baker JJ. A nursing process model: quantifying infusion therapy resource consumption. *J Infus Nurs* 2004; 27:232-44.
27. Tomford JW, Hershey CO. The i.v. therapy team: impact on patient care and costs of hospitalization. *NITA* 1985; 8:387-9.
28. Davis D, O'Brien MA, Freemantle N, Wolf FM, Mazmanian P, Taylor-Vaisey A. Impact of formal continuing medical education: do conferences, workshops, rounds, and other traditional continuing education activities change physician behavior or health care outcomes? *JAMA* 1999; 282:867-74.
29. Alonso-Echanove J, Edwards JR, Richards MJ, et al. Effect of nurse staffing and antimicrobial-impregnated central venous catheters on the risk for bloodstream infections in intensive care units. *Infect Control Hosp Epidemiol* 2003; 24:916-25.
30. Fridkin SK, Pear SM, Williamson TH, Galgiani JN, Jarvis WR. The role of understaffing in central venous catheter-associated bloodstream infections. *Infect Control Hosp Epidemiol* 1996; 17: 150-8.
31. Robert J, Fridkin SK, Blumberg HM, et al. The influence of the composition of the nursing staff on primary bloodstream infection rates in a surgical intensive care unit. *Infect Control Hosp Epidemiol* 2000; 21:12-7.
32. Maki DG, Goldman DA, Rhame FS. Infection control in intravenous therapy. *Ann Intern Med* 1973; 79:867-87.
33. Band JD, Maki DG. Steel needles used for intravenous therapy. Morbidity in patients with hematologic malignancy. *Arch Intern Med* 1980; 140:31-4.
34. Tully JL, Friedland GH, Baldini LM, Goldmann DA. Complications of intravenous therapy with steel needles and Teflon catheters. A comparative study. *Am J Med* 1981; 70:702-6.
35. Ryder MA. Peripheral access options. *Surg Oncol Clin N Am* 1995; 4:395-427.

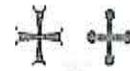
36. Maki DG, Ringer M. Risk factors for infusion-related phlebitis with small peripheral venous catheters. A randomized controlled trial. *Ann Intern Med* 1991; 114:845-54.

Rev. n° 0 del 01.06.2014



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

37. Mermel LA, McCormick RD, Springman SR, Maki DG. The pathogenesis and epidemiology of catheter-related infection with pulmonary artery Swan-Ganz catheters: a prospective study utilizing molecular subtyping. *Am J Med* 1991; 91:197S-205.
38. Parienti JJ, Thirion M, Megarbane B, et al. Femoral vs jugular venous catheterization and risk of nosocomial events in adults requiring acute renal replacement therapy: a randomized controlled trial. *JAMA* 2008; 299:2413-22.
39. Moretti EW, Ofstead CL, Kristy RM, Wetzler HP. Impact of central venous catheter type and methods on catheter-related colonization and bacteraemia. *J Hosp Infect* 2005; 61:139-45.
40. Nagashima G, Kikuchi T, Tsuyuzaki H, et al. To reduce catheter-related bloodstream infections: is the subclavian route better than the jugular route for central venous catheterization? *J Infect Chemother* 2006; 12:363-5.
41. Ruesch S, Walder B, Tramer MR. Complications of central venous catheters: internal jugular versus subclavian access—a systematic review. *Crit Care Med* 2002; 30:454-60.
42. Sadoyama G, Gontijo Filho PP. Comparison between the jugular and subclavian vein as insertion site for central venous catheters: microbiological aspects and risk factors for colonization and infection. *Braz J Infect Dis* 2003; 7:142-8.
43. Heard SO, Wagle M, Vijayakumar E, et al. Influence of triple-lumen central venous catheters coated with chlorhexidine and Silver sulfadiazine on the incidence of catheter-related bacteremia. *Arch Intern Med* 1998; 158:81-7.
44. Richet H, Hubert B, Nitemberg G, et al. Prospective multicenter study of vascular-catheter-related complications and risk factors for positive central-catheter cultures in intensive care unit patients. *J Clin Microbiol* 1990; 28:2520-5.
45. Safdar N, Kluger DM, Maki DG. A review of risk factors for catheter-related bloodstream infection caused by percutaneously inserted, noncuffed central venous catheters: implications for preventive strategies. *Medicine (Baltimore)* 2002; 81:466-79.
46. Lorente L, Jimenez A, Iribarren JL, Jimenez JJ, Martin MM, Mora ML. The micro-organism responsible for central venous catheter related bloodstream infection depends on catheter site. *Intensive Care Med* 2006; 32:1449-50.
47. Traore O, Liotier J, Souweine B. Prospective study of arterial and central venous catheter colonization and of arterial and central venous catheter-related bacteremia in intensive care units. *Crit Care Med* 2005; 33:1276-80.
48. Joynt GM, Kew J, Gomersall CD, Leung VY, Liu EK. Deep venous thrombosis caused by femoral venous catheters in critically ill adult patients. *Chest* 2000; 117:178-83.

49. Mian NZ, Bayly R, Schreck DM, Besserman EB, Richmand D. Incidence of deep venous thrombosis associated with femoral venous catheterization. Acad Emerg Med 1997; 4:1118-21.

Rev. n° 0 del 01.06.2014

50. Merrer J, De Jonghe B, Golliot F, et al. Complications of femoral and subclavian venous catheterization in critically ill patients: a randomized controlled trial. *JAMA* 2001; 286:700-7.
51. Goetz AM, Wagener MM, Miller JM, Muder RR. Risk of infection due to central venous catheters: effect of site of placement and catheter type. *Infect Control Hosp Epidemiol* 1998; 19:842-5.
52. Robinson JF, Robinson WA, Cohn A, Garg K, Armstrong JD, 2nd. Perforation of the great vessels during central venous line placement. *Arch Intern Med* 1995; 155:1225-8.
53. Trotter SJ, Veremakis C, O'Brien J, Auer AI. Femoral deep vein thrombosis associated with central venous catheterization: results from a prospective, randomized trial. *Crit Care Med* 1995; 23:52-9.
54. Lorente L, Henry C, Martin MM, Jimenez A, Mora ML. Central venous catheter-related infection in a prospective and observational study of 2,595 catheters. *Crit Care* 2005; 9:R631-5.
55. Schillinger F, Schillinger D, Montagnac R, Milcent T. Post catheterisation vein stenosis in haemodialysis: comparative angiographic study of 50 subclavian and 50 internal jugular accesses. *Nephrol Dial Transplant* 1991; 6:722-4.
56. Cimochoowski GE, Worley E, Rutherford WE, Sartain J, Blondin J, Harter H. Superiority of the internal jugular over the subclavian access for temporary dialysis. *Nephron* 1990; 54:154-61.
57. Barrett N, Spencer S, McIvor J, Brown EA. Subclavian stenosis: a major complication of subclavian dialysis catheters. *Nephrol Dial Transplant* 1988; 3:423-5.
58. Trerotola SO, Kuhn-Fulton J, Johnson MS, Shah H, Ambrosius WT, Kneebone PH. Tunneled infusion catheters: increased incidence of symptomatic venous thrombosis after subclavian versus internal jugular venous access. *Radiology* 2000; 217:89-93.
59. National Kidney Foundation. III. NKF-K/DOQI Clinical Practice Guidelines for Vascular Access: update 2000. *Am J Kidney Dis* 2001; 37:S137-81.
60. Hind D, Calvert N, McWilliams R, et al. Ultrasonic locating devices for central venous cannulation: meta-analysis. *BMJ* 2003; 327:361.
61. Randolph AG, Cook DJ, Gonzales CA, Pribble CG. Ultrasound guidance for placement of central venous catheters: a meta-analysis of the literature. *Crit Care Med* 1996; 24:2053-8.
62. Froehlich CD, Rigby MR, Rosenberg ES, et al. Ultrasound-guided central venous catheter placement decreases complications and decreases placement attempts compared with the landmark technique in patients in a pediatric intensive care unit. *Crit Care Med* 2009; 37:1090-6.
63. Lamperti M, Caldiroli D, Cortellazzi P, et al. Safety and efficacy of ultrasound assistance during internal jugular vein cannulation in neurosurgical infants. *Intensive Care Med* 2008; 34:2100-5.

64. Schweickert WD, Herlitz J, Pohlman AS, Gehlbach BK, Hall JB, Kress JP. A randomized, controlled trial evaluating postinsertion neck ultrasound in peripherally inserted central catheter procedures. *Crit Care Med* 2009; 37:1217-21.

Rev. nº 0 del 01.06.2014



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

65. Clark-Christoff N, Watters VA, Sparks W, Snyder P, Grant JP. Use of triple-lumen subclavian catheters for administration of total parenteral nutrition. *JPEN J Parenter Enteral Nutr* 1992; 16:403-7.
66. Early TF, Gregory FU, Wheeler JR, Snyder SO Jr., Gayle RG. Increased infection rate in double-lumen versus single-lumen Hickman catheters in cancer patients. *South Med J* 1990; 83:34-6.
67. Hilton E, Haslett TM, Borenstein MT, Tucci V, Isenberg HD, Singer C. Central catheter infections: single-versus triple-lumen catheters. Influence of guide wires on infection rates when used for replacement of catheters. *Am J Med* 1988; 84:667-72.
68. Yeung C, May J, Hughes R. Infection rate for single lumen v triple lumen subclavian catheters. *Infect Control Hosp Epidemiol* 1988; 9:154-8.
69. Pronovost P, Needham D, Berenholtz S, et al. An intervention to decrease catheter-related bloodstream infections in the ICU. *N Engl J Med* 2006; 355:2725-32.
70. Berenholtz SM, Pronovost PJ, Lipsett PA, et al. Eliminating catheter-related bloodstream infections in the intensive care unit. *Crit Care Med* 2004; 32:2014-20.
71. Lederle FA, Parenti CM, Berskow LC, Ellingson KJ. The idle intravenous catheter. *Ann Intern Med* 1992; 116:737-8.
72. Parenti CM, Lederle FA, Impola CL, Peterson LR. Reduction of unnecessary intravenous catheter use. Internal medicine house staff participate in a successful quality improvement project. *Arch Intern Med* 1994; 154:1829-32.
73. Abi-Said D, Raad I, Umphrey J, et al. Infusion therapy team and dressing changes of central venous catheters. *Infect Control Hosp Epidemiol* 1999; 20:101-5.
74. Capdevila JA, Segarra A, Pahissa A. Catheter-related bacteremia in patients undergoing hemodialysis. *Ann Intern Med* 1998; 128:600.
75. Mermel LA, Maki DG. Infectious complications of Swan-Ganz pulmonary artery catheters. Pathogenesis, epidemiology, prevention, and management. *Am J Respir Crit Care Med* 1994; 149:1020-36.
76. Raad II, Hohn DC, Gilbreath BJ, et al. Prevention of central venous catheter-related infections by using maximal sterile barrier precautions during insertion. *Infect Control Hosp Epidemiol* 1994; 15:231-8.
77. Boyce JM, Pittet D. Guideline for hand hygiene in health-care settings: recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *Infect Control Hosp Epidemiol* 2002; 23:S3-40.

78. Bischoff WE, Reynolds TM, Sessler CN, Edmond MB, Wenzel RP. Handwashing compliance by health care workers: the impact of introducing an accessible, alcohol-based hand antiseptic. Arch Intern Med 2000; 160:1017-21.

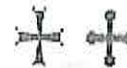
79. Pittet D, Dharan S, Touveneau S, Sauvan V, Perneger TV. Bacterial contamination of the hands of hospital staff during routine patient care. Arch Intern Med 1999; 159:821-6.

Linee guida per la prevenzione delle infezioni da cateteri intravascolari	Rev. n° 0 del 01.06.2014
	Pagina 28 di 54



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

80. Carrer S, Bocchi A, Bortolotti M, et al. Effect of different sterile barrier precautions and central venous catheter dressing on the skin colonization around the insertion site. *Minerva Anestesiol* 2005; 71:197-206.
81. Cohen Y, Fosse JP, Karoubi P, et al. The "hands-off" catheter and the prevention of systemic infections associated with pulmonary artery catheter: a prospective study. *Am J Respir Crit Care Med* 1998; 157:284-7.
82. Maki DG, Ringer M, Alvarado CJ. Prospective randomised trial of povidone-iodine, alcohol, and chlorhexidine for prevention of infection associated with central venous and arterial catheters. *Lancet* 1991; 338:339-43.
83. Mimoz O, Pieroni L, Lawrence C, et al. Prospective, randomized trial of two antiseptic solutions for prevention of central venous or arterial catheter colonization and infection in intensive care unit patients. *Crit Care Med* 1996; 24:1818-23.
84. Maki DG, Stolz SS, Wheeler S, Mermel LA. A prospective, randomized trial of gauze and two polyurethane dressings for site care of pulmonary artery catheters: implications for catheter management. *Crit Care Med* 1994; 22:1729-37.
85. Bijma R, Girbes AR, Kleijer DJ, Zwaveling JH. Preventing central venous catheter-related infection in a surgical intensive-care unit. *Infect Control Hosp Epidemiol* 1999; 20:618-20.
86. Madeo M, Martin CR, Turner C, Kirkby V, Thompson DR. A randomized trial comparing Arglaes (a transparent dressing containing Silver ions) to Tegaderm (a transparent polyurethane dressing) for dressing peripheral arterial catheters and central vascular catheters. *Intensive Crit Care Nurs* 1998; 14:187-91.
87. Raserò L, Degl'Innocenti M, Mocali M, et al. Comparison of two different time interval protocols for central venous catheter dressing in bone marrow transplant patients: results of a randomized, multicenter study. The Italian Nurse Bone Marrow Transplant Group (GITMO). *Haematologica* 2000; 85:275-9.
88. Zakrzewska-Bode A, Muytjens HL, Liem KD, Hoogkamp-Korstanje JA. Mupirocin resistance in coagulase-negative staphylococci, after topical prophylaxis for the reduction of colonization of central venous catheters. *J Hosp Infect* 1995; 31:189-93.
89. Flowers RH, Schwenger KJ, Kopel RF, Fisch MJ, Tucker SI, Farr BM. Efficacy of an attachable subcutaneous cuff for the prevention of intravascular catheter-related infection. A randomized, controlled trial. *JAMA* 1989; 261:878-83.
90. Robbins J, Cromwell P, Korones DN. Swimming and central venous catheter-related infections in the child with cancer. *J Pediatr Oncol Nurs* 1999; 16:51-6.

91. Howell PB, Walters PE, Donowitz GR, Farr BM. Risk factors for infection of adult patients with cancer who have tunneled central venous catheters. *Cancer* 1995; 75:1367-75.

92. Ivy DD, Calderbank M, Wagner BD, et al. Closed-hub systems with protected connections and the reduction of risk of catheter-related bloodstream infection in pediatric patients receiving intravenous prostanoic therapy for pulmonary hypertension. *Infect Control Hosp Epidemiol* 2009; 30:823-9.

Rev. n° 0 del 01.06.2014

93. Timsit JF, Schwebel C, Bouadma L, et al. Chlorhexidine-impregnated sponges and less frequent dressing changes for prevention of catheter-related infections in critically ill adults: a randomized controlled trial. *JAMA* 2009; 301:1231-41.
94. Rao SP, Oreopoulos DG. Unusual complications of a polyurethane PD catheter. *Perit Dial Int* 1997; 17:410-2.
95. Riu S, Ruiz CG, Martinez-Vea A, Peralta C, Oliver JA. Spontaneous rupture of polyurethane peritoneal catheter. A possible deleterious effect of mupirocin ointment. *Nephrol Dial Transplant* 1998; 13:1870-1.
96. Garland JS, Alex CP, Mueller CD, et al. A randomized trial comparing povidone-iodine to a chlorhexidine gluconate-impregnated dressing for prevention of central venous catheter infections in neonates. *Pediatrics* 2001; 107:1431-6.
97. Ho KM, Litton E. Use of chlorhexidine-impregnated dressing to prevent vascular and epidural catheter colonization and infection: a meta-analysis. *J Antimicrob Chemother* 2006; 58:281-7.
98. Levy I, Katz J, Solter E, et al. Chlorhexidine-impregnated dressing for prevention of colonization of central venous catheters in infants and children: a randomized controlled study. *Pediatr Infect Dis J* 2005; 24:676-9.
99. Lorenzen AN, Itkin DJ. Surveillance of infection in home care. *Am J Infect Control* 1992; 20:326-9.
100. White MC. Infections and infection risks in home care settings. *Infect Control Hosp Epidemiol* 1992; 13:535-9.
101. White MC, Ragland KE. Surveillance of intravenous catheter-related infections among home care clients. *Am J Infect Control* 1994; 22:231-5.
102. Bleasdale SC, Trick WE, Gonzalez IM, Lyles RD, Hayden MK, Weinstein RA. Effectiveness of chlorhexidine bathing to reduce catheter-associated bloodstream infections in medical intensive care unit patients. *Arch Intern Med* 2007; 167:2073-9.
103. Munoz-Price LS, Hota B, Sterner A, Weinstein RA. Prevention of bloodstream infections by use of daily chlorhexidine baths for patients at a long-term acute care hospital. *Infect Control Hosp Epidemiol* 2009; 30:1031-5.
104. Popovich KJ, Hota B, Hayes R, Weinstein RA, Hayden MK. Effectiveness of routine patient cleansing with chlorhexidine gluconate for infection prevention in the medical intensive care unit. *Infect Control Hosp Epidemiol* 2009; 30:959-63.
105. Yamamoto AJ, Solomon JA, Soulen MC, et al. Sutureless securement device reduces complications of peripherally inserted central venous catheters. *J Vasc Interv Radiol* 2002; 13:77-81.

106. Brun-Buisson C, Doyon F, Sollet JP, Cochard JF, Cohen Y, Nitenberg G. Prevention of intravascular catheter-related infection with newer chlorhexidine-silver sulfadiazine-coated catheters: a randomized controlled trial. *Intensive Care Med* 2004; 30:837-43.

Rev. n° 0 del 01.06.2014

107. Ostendorf T, Meinhold A, Harter C, et al. Chlorhexidine and silver-sulfadiazine coated central venous catheters in haematological patients-a double-blind, randomised, prospective, controlled trial, *Support Care Cancer* 2005; 13:993-1000.
108. Rupp ME, Lisco SJ, Lipsett PA, et al. Effect of a second-generation venous catheter impregnated with chlorhexidine and Silver sulfadiazine on central catheter-related infections: a randomized, controlled trial. *Ann Intern Med* 2005; 143:570-80.
109. Darouiche RO, Raad II, Heard SO, et al. A comparison of two antimicrobial-impregnated central venous catheters. *Catheter Study Group. N Engl J Med* 1999; 340:1-8.
110. Raad I, Darouiche R, Dupuis J, et al. Central venous catheters coated with minocycline and rifampin for the prevention of catheter-related colonization and bloodstream infections. A randomized, double-blind trial. *The Texas Medical Center Catheter Study Group. Ann Intern Med* 1997; 127:267-74.
111. Hanna H, Benjamin R, Chatziniolaou I, et al. Long-term silicone central venous catheters impregnated with minocycline and rifampin decrease rates of catheter-related bloodstream infection in cancer patients: a prospective randomized clinical trial. *J Clin Oncol* 2004; 22:3163-71.
112. Bhutta A, Gilliam C, Honeycutt M, et al. Reduction of bloodstream infections associated with catheters in paediatric intensive care unit: stepwise approach. *BMJ* 2007; 334:362-5.
113. Chelliah A, Heydon KH, Zaoutis TE, et al. Observational trial of antibiotic-coated central venous catheters in critically ill pediatric patients. *Pediatr Infect Dis J* 2007; 26:816-20.
114. van de Wetering MD, van Woensel JBM. Prophylactic antibiotics for preventing early central venous catheter Gram positive infections in oncology patients. *Cochrane Database of Systematic Reviews* 2007; Issue 1. Art. No.: CD003295. DOI: 10.1002/14651858.CD003295.pub2.
115. Maki DG, Band JD. A comparative study of polyantibiotic and iodophor ointments in prevention of vascular catheter-related infection. *Am J Med* 1981; 70:739-44.
116. Fukunaga A, Naritaka H, Fukaya R, Tabuse M, Nakamura T. Povidone-iodine ointment and gauze dressings associated with reduced catheter-related infection in seriously ill neurosurgical patients. *Infect Control Hosp Epidemiol* 2004; 25:696-8.
117. Johnson DW, MacGinley R, Kay TD, et al. A randomized controlled trial of topical exit site mupirocin application in patients with tunneled, cuffed haemodialysis catheters. *Nephrol Dial Transplant* 2002; 17:1802-7.
118. Fong IW. Prevention of haemodialysis and peritoneal dialysis catheter related infection by topical povidone-iodine. *Postgrad Med J* 1993; 69(Suppl 3):S15-7.
119. Levin A, Mason AJ, Jindal KK, Fong IW, Goldstein MB. Prevention of hemodialysis subclavian vein catheter infections by topical povidone-iodine. *Kidney Int* 1991; 40:934-8.

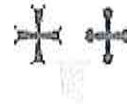
120. Schwartz C, Henrickson KJ, Roghmann K, Powell K. Prevention of bacteremia attributed to luminal colonization of tunneled central venous catheters with vancomycin-susceptible organisms. *J Clin Oncol* 1990;8:1591-7.

Rev. n° 0 del 01.06.2014



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

121. Rackoff WR, Weiman M, Jakobowski D, et al. A randomized, controlled trial of the efficacy of a heparin and vancomycin solution in preventing central venous catheter infections in children. *J Pediatr* 1995; 127:147-51.
122. Carratala J, Niubo J, Fernandez-Sevilla A, et al. Randomized, double-blind trial of an antibiotic-lock technique for prevention of gram-positive central venous catheter-related infection in neutropenic patients with cancer. *Antimicrob Agents Chemother* 1999; 43:2200-4.
123. Jurewitsch B, Lee T, Park J, Jeejeebhoy K. Taurolidine 2% as an antimicrobial lock solution for prevention of recurrent catheter-related bloodstream infections. *J Parenter Enferm Nutr* 1998; 22:242-4.
124. Henrickson KJ, Axtell RA, Hoover SM, et al. Prevention of central venous catheter-related infections and thrombotic events in immunocompromised children by the use of vancomycin/ciprofloxacin/heparin flush solution: a randomized, multicenter, double-blind trial. *J Clin Oncol* 2000; 18:1269-78.
125. Garland JS, Alex CP, Henrickson KJ, McAuliffe TL, Maki DG. A vancomycin-heparin lock solution for prevention of nosocomial bloodstream infection in critically ill neonates with peripherally inserted central venous catheters: a prospective, randomized trial. *Pediatrics* 2005; 116:e198-205.
126. Daghistani D, Horn M, Rodriguez Z, Schoenike S, Toledano S. Prevention of indwelling central venous catheter sepsis. *Med Pediatr Oncol* 1996; 26:405-8.
127. Barriga FJ, Varas M, Potin M, et al. Efficacy of a vancomycin solution to prevent bacteremia associated with an indwelling central venous catheter in neutropenic and non-neutropenic cancer patients. *Med Pediatr Oncol* 1997; 28:196-200.
128. Dogra GK, Herson H, Hutchison B, et al. Prevention of tunneled hemodialysis catheter-related infections using catheter-restricted filling with gentamicin and citrate: a randomized controlled study. *J Am Soc Nephrol* 2002; 13:2133-9.
129. Allon M. Prophylaxis against dialysis catheter-related bacteremia with a novel antimicrobial lock solution. *Clin Infect Dis* 2003; 36:1539-44.
130. Elhassan NO, Stevens TP, Gigliotti F, Hardy DJ, Cole CA, Sinkin RA. Vancomycin usage in central venous catheters in a neonatal intensive care unit. *Pediatr Infect Dis J* 2004; 23:201-6.
131. McIntyre CW, Hulme U, Taal M, Fluck RJ. Locking of tunneled hemodialysis catheters with gentamicin and heparin. *Kidney Int* 2004; 66:801-5.
132. Betjes MG, van Agteren M. Prevention of dialysis catheter-related sepsis with a citrate-taurolidine-containing lock solution. *Nephrol Dial Transplant* 2004; 19:1546-1.

133. Weijmer MC, van den Dorpel MA, Van de Ven PJ, et al. Randomized, clinical trial comparison of trisodium citrate 30% and heparin as catheter-locking solution in hemodialysis patients. *J Am Soc Nephrol* 2005; 16:2769-77.

Rev. n° 0 del 01.06.2014

134. Bleyer AJ, Mason L, Russell G, Raad II, Sherertz RJ. A randomized, controlled trial of a new vascular catheter flush solution (minocycline-EDTA) in temporary hemodialysis access. *Infect Control Hosp Epidemiol* 2005; 26:520-4.
135. Kim SH, Song KI, Chang JW, et al. Prevention of uncuffed hemodialysis catheter-related bacteremia using an antibiotic lock technique: a prospective, randomized clinical trial. *Kidney Int* 2006; 69:161-4.
136. Al-Hwlesh AK, Abdul-Rahman IS. Successful prevention of tunneled, central catheter infection by antibiotic lock therapy using vancomycin and gentamycin. *Saudi J Kidney Dis Transpl* 2007; 18:239-47.
137. Nori US, Manoharan A, Yee J, Besarab A. Comparison of low-dose gentamicin with minocycline as catheter lock solutions in the prevention of catheter-related bacteremia. *Am J Kidney Dis* 2006; 48:596-605.
138. Saxena AK, Panhotra BR, Sundaram DS, et al. Tunneled catheters' outcome optimization among diabetics on dialysis through antibiotic-lock placement. *Kidney Int* 2006; 70:1629-35.
139. Randolph AG, Cook DJ, Gonzales CA, Andrew M. Benefit of heparin in central venous and pulmonary artery catheters: a meta-analysis of randomized controlled trials. *Chest* 1998; 113:165-71.
140. Tager IB, Ginsberg MB, Ellis SE, et al. An epidemiologic study of the risks associated with peripheral intravenous catheters. *Am J Epidemiol* 1983; 118:839-51.
141. Lai KK. Safety of prolonging peripheral cannula and i.v. tubing use from 72 hours to 96 hours. *Am J Infect Control* 1998; 26:66-70.
142. van Donk P, Rickard CM, McGrail MR, Doolan G. Routine replacement versus clinical monitoring of peripheral intravenous catheters in a regional hospital in the home program: a randomized controlled trial. *Infect Control Hosp Epidemiol* 2009; 30:915-7.
143. Webster J, Clarke S, Paterson D, et al. Routine care of peripheral intravenous catheters versus clinically indicated replacement: randomised controlled trial. *BMJ* 2008; 337:a339.
144. Webster J, Osborne S, Rickard C, Hall J. Clinically-indicated replacement versus routine replacement of peripheral venous catheters. *Cochrane Database Syst Rev* 2010; 3:CD007798.
145. Boo NY, Wong NC, Zulkifli SS, Lye MS. Risk factors associated with umbilical vascular catheter-associated thrombosis in newborn infants. *J Paediatr Child Health* 1999; 35:460-5.
146. Garland JS, Buck RK, Maloney P, et al. Comparison of 10% povidone-iodine and 0.5% chlorhexidine gluconate for the prevention of peripheral intravenous catheter colonization in neonates: a prospective trial. *Pediatr Infect Dis J* 1995; 14:510-6.

147. Krauss AN, Albert RF, Kannan MM. Contamination of umbilical catheters in the newborn infant. *J Pediatr* 1970; 77:965-9.

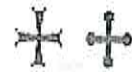
148. Landers S, Moise AA, Fraley JK, Smith EO, Baker CJ. Factors associated with umbilical catheter-related sepsis in neonates. *Am J Dis Child* 1991; 145:675-80.

Rev. n° 0 del 01.06.2014



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

149. Cronin WA, Germanson TP, Donowitz LG. Intravascular catheter colonization and related bloodstream infection in critically ill neonates. *Infect Control Hosp Epidemiol* 1990; 11:301-8.
150. Miller KL, Coen PE, White WJ, Hurst WJ, Achey BE, Lang CM. Effectiveness of skin absorption of tincture of I in blocking radiiodine from the human thyroid gland. *Health Phys* 1989; 56:911-4.
151. Ankola PA, Atakent YS. Effect of adding heparin in very low concentration to the infusate to prolong the patency of umbilical artery catheters. *Am J Perinatol* 1993; 10:229-32.
152. David PJ, Merten DF, Anderson JC, Gross S. Prevention of umbilical artery catheter clots with heparinized infusates. *Dev Pharmacol Ther* 1981; 2:117-26.
153. Horgan MJ, Bartoletti A, Polansky S, Peters JC, Manning TJ, Lamont BM. Effect of heparin infusates in umbilicalarterialcatheters on frequencyof thrombotic complications. *J Pediatr* 1987; 111:774-8.
154. Fletcher MA, Brown DR., Landers S, Seguin J. Umbilical arterial catheter use: report of an audit conducted by the Study Group for Complications of Perinatal Care. *Am J Perinatol* 1994; 11:94-9.
155. Seguin J, Fletcher MA, Landers S, Brown D, Macpherson T. Umbilical venous catheterizations: audit by the Study Group for Complications of Perinatal Care. *Am J Perinatol* 1994; 11:67-70.
156. Loisel DB, Smith MM, MacDonald MG, Martin GR. Intravenous access in newborn infants: impact of extended umbilical venous catheter use on requirement for peripheral venous lines. *J Perinatol* 1996; 16:461-6.
157. Martin C, Saux P, Papazian L, Gouin F. Long-term arterial cannulation in ICU patients using the radial artery or dorsalis pedis artery. *Chest* 2001; 119:901-6.
158. Koh DB, Gowardman JR, Rickard CM, Robertson IK, Brown A. Prospective study of peripheral arterial catheter infection and comparison with concurrently sited central venous catheters. *Crit Care Med* 2008; 36:397-402.
159. Rijnders BJ, Van Wijngaerden E, Wilmer A, Peetermans WE. Use of full sterile barrier precautions during insertion of arterial catheters: a randomized trial. *Clin Infect Dis* 2003; 36:743-8.
160. Donowitz LG, Marsik FJ, Hoyt JW, Wenzel RP. *Serratia marcescens* bacteremia from contaminated pressure transducers. *JAMA* 1979; 242:1749-51.
161. Luskin RL, Weinstein RA, Nathan C, Chamberlin WH, Kabins SA. Extended use of disposable pressure transducers. A bacteriologic evaluation. *JAMA* 1986; 255:916-20.
162. Maki DG, Hassemer CA. Endemic rate of fluid contamination and related septicemia in arterial pressure monitoring. *Am J Med* 1981; 70:733-8.

163. Mermel LA, Maki DG. Epidemic bloodstream infections from hemodynamic pressure monitoring: signs of the times. *Infect Control Hosp Epidemiol* 1989; 10:47-53.

164. Tenold R, Priano L, Kim K, Rourke B, Marrone T. Infection potential of nondisposable pressure catheters. *Crit Care Med* 1987; 15:582-3.

Rev. n° 0 del 01.06.2014



SERVIZIO
SANITARIO
REGIONALE

Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

165. Eyer S, Brummitt C, Crossley K, Siegel R, Cerra F. Catheter-related sepsis: prospective, randomized study of three methods of long-term catheter maintenance. *Crit Care Med* 1990; 18:1073-9.
166. Raad I, Umphrey J, Khan A, Truett U, Bodey GP. The duration of placement as a predictor of peripheral and pulmonary arterial catheter infections. *J Hosp Infect* 1993; 23:17-26.
167. Thomas F, Burke JP, Parker J, et al. The risk of infection related to radial vs femoral sites for arterial catheterization. *Crit Care Med* 1983; 11:807-12.
168. Leroy O, Billiau V, Beuscart C, et al. Nosocomial infections associated with long-term radial artery cannulation. *Intensive Care Med* 1989; 15:241-6.
169. Fisher MC, Long SS, Roberts EM, Dunn JM, Balsara RK. *Pseudomonas maltophilia* bacteremia in children undergoing open heart surgery. *JAMA* 1981; 246:1571-4.
170. Stamm WE, Colella JJ, Anderson RL, Dixon RE. Indwelling arterial catheters as a source of nosocomial bacteremia. An outbreak caused by *Flavobacterium* Species. *N Engl J Med* 1975; 292:1099-102.
171. Weinstein RA, Emori TG, Anderson RL, Stamm WE. Pressure transducers as a source of bacteremia after open heart surgery. Report of an outbreak and guidelines for prevention. *Chest* 1976; 69:338-44.
172. Shinozaki T, Deane RS, Mazuzan JE Jr., Hamel AJ, Hazelton D. Bacterial contamination of arterial lines. A prospective study. *JAMA* 1983; 249:223-5.
173. Solomon SL, Alexander H, Eley JW, et al. Nosocomial fungemia in neonates associated with intravascular pressure-monitoring devices. *Pediatr Infect Dis* 1986; 5:680-5.
174. Weems JJ Jr., Chamberland ME, Ward J, Willy M, Padhye AA, Solomon SL. *Candida parapsilosis* fungemia associated with parenteral nutrition and contaminated blood pressure transducers. *J Clin Microbiol* 1987; 25:1029-32.
175. Villarino ME, Jarvis WR, O'Hara C, Bresnahan J, Clark N. Epidemic of *Serratia marcescens* bacteremia in a cardiac intensive care unit. *J Clin Microbiol* 1989; 27:2433-6.
176. Beck-Sague CM, Jarvis WR, Brook JH, et al. Epidemic bacteremia due to *Acinetobacter baumannii* in five intensive care units. *Am J Epidemiol* 1990; 132:723-33.
177. Gillies D, Wallen MM, Morrison AL, Rankin K, Nagy SA, O'Riordan 2. E. Optimal timing for intravenous administration set replacement. *Cochrane Database of Systematic Reviews* 2005; Issue 4. Art.

No.: CD003588. DOI: 10.1002/14651858.CD003588.pub2.

178. Sitges-Serra A, Linares J, Perez JL, Jaurrieta E, Lorente L. A randomized trial on the effect of tubing changes on hub contamination and catheter sepsis during parenteral nutrition. JPEN J Parenter Enferal Nutr 1985; 9:322-5.

179. Snyderman DR, Donnelly-Reidy M, Perry LK, Martin WJ. Intravenous tubing containing burettes can be safely changed at 72 hour intervals. Infect Control 1987; 8:113-6.

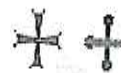
Linee guida per la prevenzione delle infezioni da cateteri intravascolari | Rev n° 0 del 01.06.2014

i Pagina 35 di 54



SERVIZIO
SANITARIO
REGIONALE

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

Dipartimento Tutela della Salute
e Politiche Sanitarie

180. Maki DG, Botticelli JT, LeRoy ML, Thielke TS. Prospective study of replacing administration sets for intravenous therapy at 48-vs 72hour intervals. 72 hours is safe and cost-effective. JAMA 1987; 258:1777-81.
181. Josephson A, Gombert ME, Sierra MF, Karanfil LV, Tansino GF. The relationship between intravenous fluid contamination and the frequency of tubing replacement. Infect Control 1985; 6:367-70.
182. Melly MA, Meng HC, Schaffner W. Microbiol growth in lipid emulsions used in parenteral nutrition. Arch Surg 1975; 110:1479-81.
183. Mershon J, Nogami W, Williams JM, Yoder C, Eitzen HE, Lemons JA. Bacterial/fungal growth in a combined parenteral nutrition solution. JPEN J Parenter Enteral Nutr 1986; 10:498-502.
184. Gilbert M, Gallagher SC, Eads M, Elmore MF. Microbial growth patterns in a total parenteral nutrition formulation containing lipid emulsion. JPEN J Parenter Enteral Nutr 1986; 10:494-7.
185. Maki DG, Martin WT. Nationwide epidemic of septicemia caused by contaminated infusion products. IV. Growth of microbial pathogens in fluids for intravenous infusions. J Infect Dis 1975; 131:267-72.
186. Bennett SN, McNeil MM, Bland LA, et al. Postoperative infections traced to contamination of an intravenous anesthetic, propofol. N Engl J Med 1995; 333:147-54.
187. Arduino MJ, Bland LA, Danzig LE, McAllister SK, Aguero SM. Microbiologic evaluation of needleless and needle-access devices. Am J Infect Control 1997; 25:377-80.
188. Brown JD, Moss HA, Elliott TS. The potential for catheter microbial contamination from a needleless connector. J Hosp Infect 1997; 36:181-9.
189. Cookson ST, Ihrig M, O'Mara EM, et al. Increased bloodstream infection rates in surgical patients associated with variation from recommended use and care following implementation of a needleless device. Infect Control Hosp Epidemiol 1998; 19:23-7.
190. Seymour VM, Dhallu TS, Moss HA, Tebbs SE, Elliot TS. A prospective clinical study to investigate the microbial contamination of a needle-less connector. J Hosp Infect 2000; 45:165-8.
191. Luebke MA, Arduino MJ, Duda DL, et al. Comparison of the microbial barrier properties of a needleless and a conventional needle-based intravenous access system. Am J Infect Control 1998; 26:437-41.
192. McDonald LC, Banerjee SN, Jarvis WR. Line-associated bloodstream infections in pediatric intensive-care-unit patients associated with a needleless device and intermittent intravenous therapy. Infect Control Hosp Epidemiol 1998; 19:772-7.

193. Mendelson MH, Short U, Schechter CB, et al. Study of a needleless intermittent intravenous-access system for peripheral infusions: analysis of staff, patient, and institutional outcomes. *Infect Control Hosp Epidemiol* 1998; 19:401-6.

194. Do AN, Ray BJ, Banerjee SN, et al. Bloodstream infection associated with needleless device use and the importance of infection-control practices in the home health care setting. *J Infect Dis* 1999; 179:442-8.

Linee guida per la prevenzione delle infezioni da cateteri intravascolari	Rev. n° 0 del 01.06.2014
	Pagina 36 di 54



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

195. Soothill JS, Bravery K, Ho A, Macqueen S, Collins J, Lock P. A fall in bloodstream infections followed a change to 2% chlorhexidine in 70% isopropanol for catheter connection antisepsis: a pediatric single center before/after study on a hemopoietic stem cell transplant ward. *Am J Infect Control* 2009; 37:626-30.
196. Casey AL, Burnell S, Whinn H, Worthington T, Faroqui MH, Elliott TS. A prospective clinical trial to evaluate the microbial barrier of a needleless connector. *J Hosp Infect* 2007; 65:212-8.
197. Rupp ME, Sholtz LA, Jourdan DR, et al. Outbreak of bloodstream infection temporally associated with the use of an intravascular needleless valve. *Clin Infect Dis* 2007; 44:1408-14.
198. Salgado CD, Chinnes L, Paczesny TH, Cantey JR. Increased rate of catheter-related bloodstream infection associated with use of a needleless mechanical valve device at a long-term acute care hospital. *Infect Control Hosp Epidemiol* 2007; 28:684-8.
199. Maragakis LL, Bradley KL, Song X, et al. Increased catheter-related bloodstream infection rates after the introduction of a new mechanical valve intravenous access port. *Infect Control Hosp Epidemiol* 2006; 27:67-70.
200. Field K, McFarlane C, Cheng AC, et al. Incidence of catheter-related bloodstream infection among patients with a needleless, mechanical valve-based intravenous connector in an Australian hematology-oncology unit. *Infect Control Hosp Epidemiol* 2007; 28:610-3.
201. Costello JM, Morrow DF, Graham DA, Potter-Bynoe G, Sandora TJ, Laussen PC. Systematic intervention to reduce central line-associated bloodstream infection rates in a pediatric cardiac intensive care unit. *Pediatrics* 2008; 121:915-23.
202. Frankel HL, Crede WB, Topal JE, Roumanis SA, Devlin MW, Foley AB. Use of corporate Six Sigma performance-improvement strategies to reduce incidence of catheter-related bloodstream infections in a surgical ICU. *J Am Coll Surg* 2005; 201:349-58.
203. Galpern D, Guerrero A, Tu A, Fahoum B, Wise L. Effectiveness of a central line bundle campaign on line-associated infections in the intensive care unit. *Surgery* 2008; 144:492-5; discussion 495.
204. McKee C, Berkowitz I, Cosgrove SE, et al. Reduction of catheter-associated bloodstream infections in pediatric patients: experimentation and reality. *Pediatr Crit Care Med* 2008; 9:40-6.
205. Pronovost PJ, Berenholtz SM, Goeschel CA. Improving the quality of measurement and evaluation in quality improvement efforts. *Am J Med Qual* 2008; 23:143-6.
206. Horan TC, Andrus M, Dudeck MA. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. *Am J Infect Control* 2008; 36:309-32.

207. Edwards JR, Peterson KD, Mu Y, et al. National Healthcare Safety Network (NHSN) report: data summary for 2006 through 2008, issued December 2009. *Am J Infect Control* 2009; 37:783-805.

208. Wisplinghoff H, Bischoff T, Tallent SM, Seifert H, Wenzel RP, Edmond MB. Nosocomial bloodstream infections in US hospitals: analysis of 24,179 cases from a prospective nationwide surveillance study. *Clin Infect Dis* 2004; 39:309-17.

Linee guida per la prevenzione delle infezioni da cateteri intravascolari Rev. n° 0 del 01.06.2014



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

209. Gaynes R, Edwards JR. Overview of nosocomial infections caused by gram-negative bacilli. *Clin Infect Dis* 2005; 41:848-54.
210. Burton DC, Edwards JR, Horan TC, Jernigan JA, Fridkin SK. Methicillin-resistant *Staphylococcus aureus* central line-associated bloodstream infections in US intensive care units, 1997-2007. *JAMA* 2009; 301:727-36.
211. Safdar N, Maki DG. The pathogenesis of catheter-related bloodstream infection with noncuffed short-term central venous catheters. *Intensive Care Med* 2004; 30:62-7.
212. Maki DG, Weise CE, Sarafin HW. A semiquantitative culture method for identifying intravenous-catheter-related infection. *N Engl J Med* 1977; 296:1305-9.
213. Raad I, Costerton W, Sabharwal U, Sacilowski M, Anaissie E, Bodey GP. Ultrastructural analysis of indwelling vascular catheters: a quantitative relationship between luminal colonization and duration of placement. *J Infect Dis* 1993; 168:400-7.
214. Dobbins BM, Kite P, Klendon A, McMahon MJ, Wilcox MH. DNA fingerprinting analysis of coagulase negative staphylococci implicated in catheter related bloodstream infections. *J Clin Pathol* 2002; 55:824-8.
215. Anaissie E, Samonis G, Kontoyiannis D, et al. Role of catheter colonization and infrequent hematogenous seeding in catheter-related infections. *Eur J Clin Microbiol Infect Dis* 1995; 14:134-7.
216. Raad I, Hanna HA, Awad A, et al. Optimal frequency of changing intravenous administration sets: is it safe to prolong use beyond 72 hours? *Infect Control Hosp Epidemiol* 2001; 22:136-9.
217. Mehall JR, Saltzman DA, Jackson RJ, Smith SD. Fibrin sheath enhances central venous catheter infection. *Crit Care Med* 2002; 30:908-12.
218. Donlan RM, Costerton JW. Biofilms: survival mechanisms of clinically relevant microorganisms. *Clin Microbiol Rev* 2002; 15:167-93.
219. Hawser SP, Douglas G. Biofilm formation by *Candida* species on the surface of catheter materials in vitro. *Infect Immun* 1994; 62: 915-21.
220. Stillman RM, Soliman F, Garda L, Sawyer PN. Etiology of catheter-associated sepsis. Correlation with thrombogenicity. *Arch Surg* 1977; 112:1497-9.
221. Raad II, Luna M, Khalil SA, Costerton JW, Lam C, Bodey GP. The relationship between the thrombotic and infectious complications of central venous catheters. *JAMA* 1994; 271:1014-6.

222. Herrmann M, Suchard SJ, Boxer LA, Waldvogel FA, Lew PD. Thrombospondin binds to *Staphylococcus aureus* and promotes staphylococcal adherence to surfaces. *Infect Immun* 1991; 59:279-88.

223. Shanks RM, Sargent JL, Martinez RM, Graber ML, OToole GA. Catheter lock solutions influence staphylococcal biofilm formation on abiotic surfaces. *Nephrol Dial Transplant* 2006; 21:2247-55.

224. Chatzinikolaou I, Zipf TF, Hanna H, et al. Minocycline-ethylenediaminetetraacetate lock solution for the prevention of implantable port infections in children with cancer. *Clin Infect Dis* 2003; 36:116-9.

Linee guida per la prevenzione delle infezioni da cateteri intravascolari | Rev. n° 0 del 01.06.2014

| "-----"-----|

| Pagina 38 di 54 |

225. McDevitt D, Francois P, Vaudaux P, Foster TJ. Identification of the ligand-binding domain of the surface-located fibrinogen receptor (dumping factor) of *Staphylococcus aureus*. *Mol Microbiol* 1995; 16:895-907.
226. Ni Eidhin D, Perkins S, Francois P, Vaudaux P, Hook M, Foster TJ. dumping factor B (ClfB), a new surface-located fibrinogen-binding adhesin of *Staphylococcus aureus*. *Mol Microbiol* 1998; 30:245-57.
227. Mack D, Davies AP, Harris LG, Rohde H, Horstkotte MA, Knobloch JK. Microbial interadions in *Staphylococcus epidermidis* biofilms. *Anal Bioanal Chem* 2007; 387:399-408.
228. von Eiff C, Peters G, Hellmann C. Pathogenesis of infections due to coagulase-negative staphylococci. *Lancet Infect Dis* 2002; 2:677-85.
229. Zhu Y, Weiss EC, Otto M, Fey PD, Smeltzer MS, Somerville GA. *Staphylococcus aureus* metabolism in a biofilm: the influence of arginine on polysaccharide intercellular adhesin synthesis, biofilm formation, and pathogenesis. *Infect Immun* 2007; 75:4219-26.
230. Murga R, Miller JM, Donlan RM. Biofilm formation by gram-negative bacteria on central venous catheter connectors: effect of conditioning films in a laboratory model. *J Clin Microbiol* 2001; 39:2294-7.
231. Douglas U. *Candida* biofilms and their role in infection. *Trends Microbiol* 2003; 11:30-6.
232. Donlan RM. Biofilms: microbial life on surfaces. *Emerg Infect Dis* 2002; 8:881-90.
233. Dunne WM Jr., Burd EM. The effects of magnesium, calcium, EDTA, and pH on the in vitro adhesion of *Staphylococcus epidermidis* to plastic. *Microbiol Immunol* 1992; 36:1019-27.
234. Ozerdem Akpolat N, Elei S, Atmaca S, Akbayin H, Gul K. The effects of magnesium, calcium and EDTA on slime production by *Staphylococcus epidermidis* strains. *Folia Microbiol (Praha)* 2003; 48:649-53.
235. Banin E, Brady KM, Greenberg EP. Chelator-induced dispersal and killing of *Pseudomonas aeruginosa* cells in a biofilm. *Appl Environ Microbiol* 2006; 72:2064-9.
236. Donlan RM. Role of biofilms in antimicrobial resistance. *ASAIO J* 2000; 46:S47-52.
237. Farber BF, Kaplan MH, Clogston AG. *Staphylococcus epidermidis* extruded slime inhibits the antimicrobial action of glycopeptide antibiotics. *J Infect Dis* 1990; 161:37-40.
238. Branchini ML, Pfaller MA, Rhine-Chalberg J, Frempong T, Isenberg HD. Genotypic variation and slime production among blood and catheter isolates of *Candida parapsilosis*. *J Clin Microbiol* 1994; 32:452-6.
239. Sanders RA, Sheldon GF. Septic complications of total parenteral nutrition. A five year experience. *Am J Surg* 1976; 132:214-20.

240. Ryan JA Jr., Abel RM, Abbott WM, et al. Catheter complications in total parenteral nutrition. A prospective study of 200 consecutive patients. *N Engl J Med* 1974; 290:757-61.

241. Murphy LM, Lipman TO. Central venous catheter care in parenteral nutrition: a review. *JPEN J Parenter Enteral Nutr* 1987; 11: 190-201. _____.

Rev. n° 0 del 01.06.2014

242. Armstrong CW, Mayhall CG, Miller KB, et al. Prospective study of catheter replacement and other risk factors for infection of hyperalimentation catheters. *J Infect Dis* 1986; 154:808-16.
243. Garland JS, Dunne WM Jr., Havens P, et al. Peripheral intravenous catheter complications in critically ill children: a prospective study. *Pediatrics* 1992; 89:1145-50.
244. Garland JS, Nelson DB, Cheah TE, Hennes HH, Johnson TM. Infectious complications during peripheral intravenous therapy with Teflon catheters: a prospective study. *Pediatr Infect Dis J* 1987; 6:918-21.
245. Breschan C, Platzer M, Jost R, Schaumberger F, Stettner H, Likar R. Comparison of catheter-related infection and tip colonization between internal jugular and subclavian central venous catheters in surgical neonates. *Anesthesiology* 2007; 107:946-53.
246. Deshpande KS, Hatem C, Ulrich HL, et al. The incidence of infectious complications of central venous catheters at the subclavian, internal jugular, and femoral sites in an intensive care unit population. *Crit Care Med* 2005; 33:13-20; discussion 234-5.
247. Durbec O, Viviand X, Potie F, Viallet R, Albanese J, Martin C. A prospective evaluation of the use of femoral venous catheters in critically ill adults. *Crit Care Med* 1997; 25:1986-9.
248. Venkataraman ST, Thompson AE, Orr RA. Femoral vascular catheterization in critically ill infants and children. *Clin Pediatr (Phila)* 1997; 36:311-9.
249. Sheridan RL, Weber JM. Mechanical and infectious complications of central venous cannulation in children: lessons learned from a 10-year experience placing more than 1000 catheters. *J Burn Care Res* 2006; 27:713-8.
250. Stenzel JP, Green TP, Fuhrman BP, Carlson PE, Marchessault RP. Percutaneous central venous catheterization in a pediatric intensive care unit: a survival analysis of complications. *Crit Care Med* 1989; 17:984-8.
251. Goldstein AM, Weber JM, Sheridan RL. Femoral venous access is safe in burned children: an analysis of 224 catheters. *J Pediatr* 1997; 130:442-6.
252. Ramos GE, Bolgiani AN, Patino O, et al. Catheter infection risk related to the distance between insertion site and burned area. *J Burn Care Rehabil* 2002; 23:266-71.
253. Sheth NK, Franson TR, Rose HD, Buckmire FL, Cooper JA, Sohnle PG. Colonization of bacteria on polyvinyl chloride and Teflon intravascular catheters in hospitalized patients. *J Clin Microbiol* 1983; 18:1061-3.
254. Maki DG, Ringer M. Evaluation of dressing regimens for prevention of infection with peripheral intravenous catheters. Gauze, a transparent polyurethane dressing, and an iodophor-transparent dressing. *JAMA* 1987; 258:2396-403.

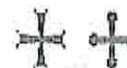
255. Pittet D, Hugonnet S, Harbath S, et al. Effectiveness of a hospital-wide programme to improve compliance with hand hygiene. Lancet 2000; 356:1307-9.

Linee guida per la prevenzione delle infezioni da cateteri intravascolari	Rev. n° 0 del 01.06.2014
	Pagina 40 di 54



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

256. Humar A, Ostromecki A, Drenfeldt J, et al. Prospective randomized trial of 10% povidone-iodine versus 0.5% tincture of chlorhexidine as cutaneous antisepsis for prevention of central venous catheter infection. *Clin Infect Dis* 2000; 31:1001-7.

257. Chaiyakunapruk N, Veenstra DL, Lipsky BA, Saint S. Chlorhexidine compared with povidone-iodine solution for vascular catheter-site care: a meta-analysis. *Ann Intern Med* 2002; 136:792-801.

258. Chaiyakunapruk N, Veenstra DL, Lipsky BA, Sullivan SD, Saint S. Vascular catheter site care: the clinical and economic benefits of chlorhexidine gluconate compared with povidone iodine. *Clin Infect Dis* 2003; 37:764-71.

259. Parienti JJ, du Cheyron D, Ramackers M, et al. Alcoholic povidone-iodine to prevent central venous catheter colonization: a randomized unit-crossover study. *Crit Care Med* 2004; 32:708-13.

260. Hoffmann KK, Weber DJ, Samsa GP, Rutala WA. Transparent polyurethane film as an intravenous catheter dressing. A meta-analysis of the infection risks. *JAMA* 1992; 267:2072-6.

261. Gillies D, O'Riordan E, Carr D, O'Brien I, Frost J, Gunning R. Central venous catheter dressings: a systematic review. *J Adv Nurs* 2003; 44:623-32.

262. Ruschulte H, Franke M, Gastmeier P, et al. Prevention of central venous catheter related infections with chlorhexidine gluconate impregnated wound dressings: a randomized controlled trial. *Ann Hematol* 2009; 88:267-72.

263. Veenstra DL, Saint S, Saha S, Lumley T, Sullivan SD. Efficacy of antiseptic-impregnated central venous catheters in preventing catheter-related bloodstream infection: a meta-analysis. *JAMA* 1999; 281:261-7.

264. Maki DG, Stolz SM, Wheeler S, Mermel LA. Prevention of central venous catheter-related bloodstream infection by use of an antiseptic-impregnated catheter. A randomized, controlled trial. *Ann Intern Med* 1997; 127:257-66.

265. Bassetti S, Hu J, D'Agostino RB Jr., and Sherertz RJ. Prolonged antimicrobial activity of a catheter containing chlorhexidine-silver sulfadiazine extends protection against catheter infections in vivo. *Antimicrob Agents Chemother* 2001; 45:1535-8.

266. Oda T, Hamasaki J, Kanda N, Mikami K. Anaphylactic shock induced by an antiseptic-coated central venous [correction of nervous] catheter. *Anesthesiology* 1997; 87:1242-4.

267. Pittaway A, Ford S. Allergy to chlorhexidine-coated central venous catheters revisited. *Br J Anaesth* 2002; 88:304-5; author reply 305.

268. Stephens R, Mythen M, Kallis P, Davies DW, Egner W, Rickards A. Two episodes of life-threatening anaphylaxis in the same patient to a chlorhexidine-sulphadiazine-coated central venous catheter. *Br J Anaesth* 2001; 87:306-8.

Linee guida per la prevenzione delle infezioni da cateteri intravascolari

269. Terazawa E, Shimonaka H, Nagase K, Masue T, Dohi S. Severe anaphylactic reaction due to a chlorhexidine-impregnated central venous catheter. *Anesthesiology* 1998; 89:1296-8.

Rev. n° 0 del 01.06.2014



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

270. Jee R, Nel L, Gnanakumaran G, Williams A, Eren E. Four cases of anaphylaxis to chlorhexidine impregnated central venous catheters: a case cluster or the tip of the iceberg? *Br J Anaesth* 2009; 103:614-5.
271. Veenstra DL, Saint S, Sullivan SD. Cost-effectiveness of antiseptic-impregnated central venous catheters for the prevention of catheter-related bloodstream infection. *JAMA* 1999; 282:554-60.
272. Tambe SM, Sampath L, Modak SM. In vitro evaluation of the risk of developing bacterial resistance to antiseptics and antibiotics used in medical devices. *J Antimicrob Chemother* 2001; 47:589-98.
273. Sampath LA, Tambe SM, Modak SM. In vitro and in vivo efficacy of catheters impregnated with antiseptics or antibiotics: evaluation of the risk of bacterial resistance to the antimicrobials in the catheters. *Infect Control Hosp Epidemiol* 2001; 22:640-6.
274. Marciante KD, Veenstra DL, Lipsky BA, Saint S. Which antimicrobial impregnated central venous catheter should we use? Modeling the costs and outcomes of antimicrobial catheter use. *Am J Infect Control* 2003; 31:1-8.
275. Shorr AF, Humphreys CW, Helman DL. New choices for central venous catheters: potential financial implications. *Chest* 2003; 124:275-84.
276. Hagau N, Studnicska D, Gavrus RL, Csipak G, Hagau R, Slavcovic AV. Central venous catheter colonization and catheter-related bloodstream infections in critically ill patients: a comparison between standard and silver-integrated catheters. *Eur J Anaesthesiol* 2009; 26:752-8.
277. Bong JJ, Kite P, Wilco MH, McMahon MJ. Prevention of catheter related bloodstream infection by Silver iontophoretic central venous catheters: a randomised controlled trial. *J Clin Pathol* 2003; 56:731-5.
278. Corrai L, Nolla-Salas M, Ibanez-Nolla J, et al. A prospective, randomized study in critically ill patients using the Oligon Vantex catheter. *J Hosp Infect* 2003; 55:212-9.
279. Ranucci M, Isgro G, Giomarelli PP, et al. Impact of oligon central venous catheters on catheter colonization and catheter-related bloodstream infection. *Crit Care Med* 2003; 31:52-9.
280. Raad II, Hachem RY, Abi-Said D, et al. A prospective crossover randomized trial of novobiocin and rifampin prophylaxis for the prevention of intravascular catheter infections in cancer patients treated with interleukin-2. *Cancer* 1998; 82:403-11.
281. McKee R, Dunsmuir R, Whitby M, Garden OJ. Does antibiotic prophylaxis at the time of catheter insertion reduce the incidence of catheter-related sepsis in intravenous nutrition? *J Hosp Infect* 1985; 6:419-25.
282. Sandoe JA, Kumar B, Stoddart B, et al. Effect of extended perioperative antibiotic prophylaxis on intravascular catheter colonization and infection in cardiothoracic surgery patients. *J Antimicrob*

Chemother
2003; 52:877-9.

283. Inglis GDT, Jardine LA, Davies MW. Prophylactic antibiotics to reduce morbidity and mortality in neonates with umbilical artery catheters. Cochrane Database of Systematic Reviews 2007; Issue 4. Art.

Rev. n° 0 del 01.06.2014

284. Craft AP, Finer N, Barrington KJ. Vancomycin for prophylaxis against sepsis in preterm neonates. *Cochrane Database of Systematic Reviews* 2000; Issue 1. Art. No.: CD001971. DOI: 10.1002/14651858. CD001971.
285. Norden CW. Application of antibiotic ointment to the site of venous catheterization-a controlled trial. *J Infect Dis* 1969; 120:611-5.
286. Zinner SH, Denny-Brown BC, Braun P, Burke JP, Toala P, Kass EH. Risk of infection with intravenous indwelling catheters: effect of application of antibiotic ointment. *J Infect Dis* 1969; 120:616-9.
287. von Eiff C, Becker K, Machka K, Stammer H, Peters G. Nasal carriage as a source of *Staphylococcus aureus* bacteremia. *N Engl J Med* 2001; 344:11-6.
288. Chow JW, Yu VL. *Staphylococcus aureus* nasal carriage in hemodialysis patients. Its role in infection and approach to prophylaxis. *Arch Intern Med* 1989; 149:1258-62.
289. Yu VL, Goetz A, Wagener M, et al. *Staphylococcus aureus* nasal carriage and infection in patients on hemodialysis. Efficacy of antibiotic prophylaxis. *N Engl J Med* 1986; 315:91-6.
290. Casewell MW. The nose: an underestimated source of *Staphylococcus aureus* causing wound infection. *J Hosp Infect* 1998; 40:S3-11.
291. Hill RL, Fisher AP, Ware PO, Wilson S, Casewell MW. Mupirocin for the reduction of colonization of internal jugular cannulae-a randomized controlled trial. *J Hosp Infect* 1990; 15:311-21.
292. Sesso R, Barbosa D, Leme IL, et al. *Staphylococcus aureus* prophylaxis in hemodialysis patients using central venous catheter: effect of mupirocin ointment. *J Am Soc Nephrol* 1998; 9:1085-92.
293. Boelaert JR, Van Landuyt HW, Godard CA, et al. Nasal mupirocin ointment decreases the incidence of *Staphylococcus aureus* bacteraemias in haemodialysis patients. *Nephrol Dial Transplant* 1993; 8:235-9.
294. Netto dos Santos KR, de Souza Fonseca L, Gontijo Filho PP. Emergence of high-level mupirocin resistance in methicillin-resistant *Staphylococcus aureus* isolated from Brazilian university hospitals. *Infect Control Hosp Epidemiol* 1996; 17:813-6.
295. Miller MA, Dascal A, Portnoy J, Mendelson J. Development of mupirocin resistance among methicillin-resistant *Staphylococcus aureus* after widespread use of nasal mupirocin ointment. *Infect Control Hosp Epidemiol* 1996; 17:811-3.
296. Lok CE, Stanley KE, Hux JE, Richardson R, Tobe SW, Conly J. Hemodialysis infection prevention with polysporin ointment. *J Am Soc Nephrol* 2003; 14:169-79.

297. Yahav D, Rozen-Zvi B, Gafter-Gvili A, Leibovici L, Gafter U, Paul M. Antimicrobial lock solutions for the prevention of infections associated with intravascular catheters in patients undergoing hemodialysis: systematic review and meta-analysis of randomized, controlled trials. *Clin Infect Dis* 2008; 47:83-93.

Rev. n° 0 del 01.06.2014

298. Labriola L, Crott R, Jadoul M. Preventing haemodialysis catheter-related bacteraemia with an antimicrobial lock solution: a metaanalysis of prospective randomized trials. *Nephrol Dial Transplant* 2008; 23:1666-72.
299. Jaffer Y, Selby NM, Taal MW, Fluck RJ, McIntyre CW. A meta-analysis of hemodialysis catheter locking solutions in the prevention of catheter-related infection. *Am J Kidney Dis* 2008; 51:233-41.
300. Safdar N, Maki DG. Use of vancomycin-containing lock or flush solutions for prevention of bloodstream infection associated with central venous access devices: a meta-analysis of prospective, randomized trials. *Clin Infect Dis* 2006; 43:474-84.
301. Sanders J, Pithie A, Ganly P, et al. A prospective double-blind randomized trial comparing intraluminal ethanol with heparinized saline for the prevention of catheter-associated bloodstream infection in immunosuppressed haematology patients. *J Antimicrob Chemother* 2008; 62:809-15.
302. Schinabeck MK, Ghannoum MA. Biofilm-related indwelling medical device infections. In: Pace 3L, Rupp ME, Finch RG, eds. *Biofilms, infection, and antimicrobial therapy*. Boca Raton: Taylor and Francis, 4. 2006: 39-50.
303. Gristina AG. Biomaterial-centered infection: microbial adhesion versus tissue integration. *Science* 1987; 237:1588-95.
304. Timsit JF, Farkas JC, Boyer JM, et al. Central vein catheter-related thrombosis in intensive care patients: incidence, risks factors, and relationship with catheter-related sepsis. *Chest* 1998; 114:207-13.
305. Eastman ME, Khorsand M, Maki DG, et al. Central venous device-related infection and thrombosis in patients treated with moderate dose continuous-infusion interleukin-2. *Cancer* 2001; 91:806-14.
306. Abdelkefi A, Torjman L, Ladeb S, et al. Randomized trial of prevention of catheter-related bloodstream infection by continuous infusion of low-dose unfractionated heparin in patients with hematologic and oncologic disease. *J Clin Oncol* 2005; 23:7864-70.
307. Mermel LA, Stolz SM, Maki DG. Surface antimicrobial activity of heparin-bonded and antiseptic-impregnated vascular catheters. *J Infect Dis* 1993; 167:920-4.
308. Pierce CM, Wade A, Mok Q. Heparin-bonded central venous lines reduce thrombotic and infective complications in critically ill children. *Intensive Care Med* 2000; 26:967-72.
309. Appelgren P, Ransjo U, Bindslev L, Espersen F, Larm O. Surface heparinization of central venous catheters reduces microbial colonization in vitro and in vivo: results from a prospective, randomized trial. *Crit Care Med* 1996; 24:1482-9.
310. Abdelkefi A, Achour W, Ben Othman T, et al. Use of heparin-coated central venous lines to prevent catheter-related bloodstream infection. *J Support Oncol* 2007; 5:273-8.

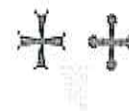
311. Carrasco MN, Bueno Aires, de las Cuevas C, et al. Evaluation of a triple-lumen central venous heparin-coated catheter versus a catheter coated with chlorhexidine and Silver sulfadiazine in critically ill patients. *Intensive Care Med* 2004; 30:633-8.

Rev. n° 0 del 01.06.2014



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

312. Levy JH, Hursting MJ. Heparin-induced thrombocytopenia, a prothrombotic disease. *Hematol Oncol Clin North Am* 2007; 21:65-88.
313. Weijmer MC, Debets-Ossenkopp YJ, Van De vondervoort FJ, ter Wee PM. Superior antimicrobial activity of trisodium citrate over heparin for catheter locking. *Nephrol Dial Transplant* 2002; 17:2189-95.
314. Boraks P, Seale J, Price J, et al. Prevention of central venous catheter associated thrombosis using minidose warfarin in patients with haematological malignancies. *Br J Haematol* 1998; 101:483-6.
315. Bern MM, Lokich JJ, Wallach SR, et al. Very low doses of warfarin can prevent thrombosis in central venous catheters. A randomized prospective trial. *Ann Intern Med* 1990; 112:423-8.
316. Akl EA, Karmath G, Yosulco VED, Kim SY, Barba M, Sperati F, Cook D, Schunemann H. Anticoagulation for thrombosis prophylaxis in cancer patients with central venous catheters. *Cochrane Database of Systematic Reviews* 2007; Issue 3. Art. No.: CD006468. DOI: 10.1002/14651858.CD006468.pub2.
317. Akl EA, Muti P, Schunemann HJ. Anticoagulation In patients with cancer: an overview of reviews. *Poi Arch Med Wewn* 2008; 118:183-93.
318. Klerk CP, Smorenburg SM, Buller HR. Thrombosis prophylaxis in patient populations with a central venous catheter: a systematic review. *Arch Intern Med* 2003; 163:1913-21.
319. Heaton DC, Han DY, Inder A. Minidose (1 mg) warfarin as prophylaxis for central vein catheter thrombosis. *Intern Med J* 2002; 32:84-8.
320. Masci G, Magagnoli M, Zucali PA, et al. Minidose warfarin prophylaxis for catheter-associated thrombosis in cancer patients: can it be safely associated with fluorouracil-based chemotherapy? *J Clin Oncol* 2003; 21:736-9.
321. Kuter DJ. Thrombotic complications of central venous catheters in cancer patients. *Oncologist* 2004; 9:207-16.
322. Fontaine PJ. Performance of a new softening expanding midline catheter in home intravenous therapy patients. *J Intraven Nurs* 1991; 14:91-9.
323. Harwood IR, Greene LM, Kozakowski-Koch JA, Rasor JS. New peripherally inserted midline catheter: a better alternative for intravenous antibiotic therapy in patients with cystic fibrosis. *Pediatr Pulmonol* 1992; 12:233-9.
324. Mermel LA, Parenteau S, Tow SM. The risk of midline catheterization in hospitalized patients. A prospective study. *Ann Intern Med* 1995; 123:841-4.

325. Uldall PR, Merchant N, Woods F, Yarworski U, Vas S. Changing subclavian haemodialysis cannulas to reduce infection. Lancet 1981; 1:1373.

326. Cook D, Randolph A, Kernerman P, et al. Central venous catheter replacement strategies: a systematic review of the literature. Crit Care Med 1997; 25:1417-24.

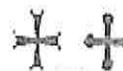
Linee guida per la prevenzione delle infezioni da cateteri intravascolari 06.2014

| Pagina 45 di 54 |



Dipartimento Tutela della Salute
e Politiche Sanitarie

AZIENDA OSPEDALIERA
"Bianchi Melacrino Morelli"
Reggio Calabria



REGIONE CALABRIA

327. Cobb DK, High KP, Sawyer RG, et al. A controlled trial of scheduled replacement of central venous and pulmonary-artery catheters. *N Engl J Med* 1992; 327:1062-8.
328. Beathard GA. Management of bacteremia associated with tunneled-cuffed hemodialysis catheters. *J Am Soc Nephrol* 1999; 10:1045-9.
329. Duszak R Jr., Haskal ZJ, Thomas-Hawkins C, et al. Replacement of fading tunneled hemodialysis catheters through pre-existing subcutaneous tunnels: a comparison of catheter function and infection rates for de novo placements and over-the-wire exchanges. *J Vasc Interv Radiol* 1998; 9:321-7.
330. Robinson D, Suhocki P, Schwab SJ. Treatment of infected tunneled venous access hemodialysis catheters with guidewire exchange. *Kidney Int* 1998; 53:1792-4.
331. Saad TF. Bacteremia associated with tunneled, cuffed hemodialysis catheters. *Am J Kidney Dis* 1999; 34:1114-24.
332. Ainsworth S, Clerihew L, McGuire W. Percutaneous central venous catheters versus peripheral cannulae for delivery of parenteral nutrition in neonates. *Cochrane Database of Systematic Reviews* 2007; Issue 3. Art. No.: CD004219. DOI: 10.1002/14651858.CD004219. pub3.
333. Shah PS, Kalyn A, Satodia P, et al. A randomized, controlled trial of heparin versus placebo infusion to prolong the usability of peripherally placed percutaneous central venous catheters (PCVCs) in neonates: the HIP (Heparin Infusion for PCVC) study. *Pediatrics* 2007; 119:e284-91.
334. Jaar BG, Hermann JA, Furth SL, Briggs W, Powe NR. Septicemia in diabetic hemodialysis patients: comparison of incidence, risk factors, and mortality with nondiabetic hemodialysis patients. *Am J Kidney Dis* 2000; 35:282-92.
335. Powe NR, Jaar B, Furth SL, Hermann J, Briggs W. Septicemia in dialysis patients: incidence, risk factors, and prognosis. *Kidney Int* 1999; 55:1081-90.
336. Hoen B, Paul-Dauphin A, Hestin D, Kessler M. EPIBACDIAL: a multicenter prospective study of risk factors for bacteremia in chronic hemodialysis patients. *J Am Soc Nephrol* 1998; 9:869-76.
337. Blot F, Chachaty E, Raynard B, Antoun S, Bourgain JL, Nitenberg G. Mechanisms and risk factors for infection of pulmonary artery catheters and introducer sheaths in cancer patients admitted to an intensive care unit. *J Hosp Infect* 2001; 48:289-97.
338. Kac G, Durain E, Amrein C, Herisson E, Fiemeyer A, Buu-Hoi A. Colonization and infection of pulmonary artery catheter in cardiac surgery patients: epidemiology and multivariate analysis of risk factors. *Crit Care Med* 2001; 29:971-5.
339. Chen YY, Yen DH, Yang YG, Liu CY, Wang FD, Chou P. Comparison between replacement at 4 days and 7 days of the infection rate for pulmonary artery catheters in an intensive care unit. *Crit Care Med* 2003; 31:1353-8.

340. Balagtas RC, Bell CE, Edwards LD, Levin S. Risk of local and systemic infections associated with umbilical vein catheterization: a prospective study in 86 newborn patients. *Pediatrics* 1971; 48:359-67.

Linee guida per la prevenzione delle infezioni da cateteri intravascolari	Rev. n° 0 del 01.06.2014
	Pagina 46 di 54

341. Butler-O'Hara M, Buzzard CJ, Reubens L, McDermott MP, DiGrazio W, D'Angio CT. A randomized trial comparing long-term and short-term use of umbilical venous catheters in premature infants with birth weights of less than 1251 grams. *Pediatrics* 2006; 118:e25-35.
342. Scheer B, Perel A, Pfeiffer UJ. Clinical review: complications and risk factors of peripheral arterial catheters used for haemodynamic monitoring in anaesthesia and intensive care medicine. *Crit Care* 2002; 6:199-204.
343. Lorente L, Santacreu R, Martin MM, Jimenez A, Mora ML. Arterial catheter-related infection of 2,949 catheters. *Crit Care* 2006; 10:R83.
344. Furfaro S, Gauthier M, Lacroix J, Nadeau D, Lafleur L, Mathews S. Arterial catheter-related infections in children. A 1-year cohort analysis. *Am J Dis Child* 1991; 145:1037-43.
345. Rickard CM, Lipman J, Courtney M, Siversen R, Daley P. Routine changing of intravenous administration sets does not reduce colonization or infection in central venous catheters. *Infect Control Hosp Epidemiol* 2004; 25:650-5.
346. Hanna HA, Raad I. Blood products: a significant risk factor for long-term catheter-related bloodstream infections in cancer patients. *Infect Control Hosp Epidemiol* 2001; 22:165-6.
347. Saiman L, Ludington E, Dawson JD, et al. Risk factors for *Candida* species colonization of neonatal intensive care unit patients. *Pediatr Infect Dis J* 2001; 20:1119-24.
348. Avila-Figueroa C, Goldmann DA, Richardson DK, Gray JE, Ferrari A, Freeman J. Intravenous lipid emulsions are the major determinant of coagulase-negative staphylococcal bacteremia in very low birth weight newborns. *Pediatr Infect Dis J* 1998; 17:10-7.
349. Cracker KS, Noga R, Filibeck DJ, Krey SH, Markovic M, Steffee WP. Microbial growth comparisons of five commercial parenteral lipid emulsions. *J Parenter Enteral Nutr* 1984; 8:391-5.
350. Jarvis WR, Highsmith AK. Bacterial growth and endotoxin production in lipid emulsion. *J Clin Microbiol* 1984; 19:17-20.
351. Karamanoglu A, Yumuk PF, Gumus M, et al. Port needles: do they need to be removed as frequently in infusional chemotherapy? *J Infus Nurs* 2003; 26:239-42.
352. Niel-Weise BS, Daha TJ, van den Broek PJ. Is there evidence for recommending needleless closed catheter access systems in guidelines? A systematic review of randomized controlled trials. *J Hosp Infect* 2006; 62:406-13.
353. Inoue Y, Nezu R, Matsuda H, et al. Prevention of catheter-related sepsis during parenteral nutrition: effect of a new connection device. *J Parenter Enteral Nutr* 1992; 16:581-5.

354. 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; 32:291-5.

Rev. n° 0 del 01.06.2014

355. Casey AL, Worthington T, Lambert PA, Quinn D, Faroqui MH, Elliott TS. A randomized, prospective clinical trial to assess the potential infection risk associated with the PosiFlow needleless connector. *J Hosp Infect* 2003; 54:288-93.

356. Esteve F, Pujol M, Limon E, et al. Bloodstream infection related to catheter connections: a prospective trial of two connection systems. *J Hosp Infect* 2007; 67:30-4.

357. Yebenes JC, Delgado M, Sauca G, et al. Efficacy of three different valve systems of needle-free closed connectors in avoiding access of microorganisms to endovascular catheters after incorrect handling. *Crit Care Med* 2008; 36:2558-61.

358. Menyhay SZ, Maki DG. Preventing central venous catheter-associated bloodstream infections: development of an antiseptic barrier cap for needleless connectors. *Am J Infect Control* 2008; 36:(Suppl 174):e1-5.

359. Jarvis WR, Murphy C, Hall KK, et al. Health care-associated bloodstream infections associated with negative-or positive-pressure or displacement mechanical valve needleless connectors. *Clin Infect Dis* 2009; 49:1821-7.

360. Menyhay SZ, Maki DG. Disinfection of needleless catheter connectors and access ports with alcohol may not prevent microbial entry: the promise of a novel antiseptic-barrier cap. *Infect Control Hosp Epidemiol* 2006; 27:23-7.

361. Safdar N, Maki DG. Lost in translation. *Infect Control Hosp Epidemiol* 2006; 27:3-7.

362. Warren DK, Yokoe DS, Climo MW, et al. Preventing catheter-associated bloodstream infections: a survey of policies for insertion and care of central venous catheters from hospitals in the prevention epicenter program. *Infect Control Hosp Epidemiol* 2006; 27:8-13.

363. O'Grady NP, Alexander M, Dellinger EP, et al. Guidelines for the prevention of intravascular catheter-related infections. Centers for Disease Control and Prevention. *MMWR Recomm Rep* 2002;51:1-29.

364. Krein SL, Hofer TP, Kowalski CP, et al. Use of central venous catheter-related bloodstream infection prevention practices by US hospitals. *Mayo Clin Proc* 2007; 82:672-8.

365. Lobo RD, Levin AS, Gomes LM, et al. Impact of an educational program and policy changes on decreasing catheter-associated bloodstream infections in a medical intensive care unit in Brazil. *Am J Infect Control* 2005; 33:83-7.

366. Marschall J, Leone C, Jones M, Nihill D, Fraser VJ, Warren DK. Catheter-associated bloodstream infections in general medical patients outside the intensive care unit: a surveillance study. *Infect Control Hosp Epidemiol* 2007; 28:905-9.

367. Rosenthal VD, McCormick RD, Guzman S, Villamayor C, Orellano PW. Effect of education and performance feedback on handwashing: the benefit of administrative support in Argentinean hospitals. *Am J Infect Control* 2003; 31:85-92. J

Rev. n° 0 del 01.06.2014

368. Gastmeier P, Geffers C. Prevention of catheter-related bloodstream infections: analysis of studies published between 2002 and 2005. *J Hosp Infect* 2006; 64:326-35.

369. Pronovost PJ, Goeschel CA, Colantuoni E, et al. Sustaining reductions in catheter related bloodstream infections in Michigan intensive care units: observational study. *BMJ* 2010; 340:c309.

370. Shapey IM, Foster MA, Whitehouse T, Jumaa P, Bion JF. Central venous catheter-related bloodstream infections: improving post-insertion catheter care. *J Hosp Infect* 2009; 71:117-22.

BIBLIOGRAFIA CONSULTATA (pubblicazioni dal 2011 al 2013)

1. Scottish Intercollegiate Guidelines Network. SIGN 50: a guideline developer's handbook . Revised edition. Edinburgh: Healthcare Improvement Scotland; 2011; Available at: <http://www.sign.ac.uk/guidelines/fulltext/50/index.html> Accessed July 25, 2013
2. Cochrane Effective Practice and Organisation of Care Review Group . EPOC resources . The Cochrane Collaboration; 2013; Available at: <http://epoc.cochrane.org/epoc-resources> Accessed 6 August, 2013.
3. Care Quality Commission . Guidance about compliance. Essential standards of quality and safety . London: Care Quality Commission; 2010; Available at: http://www.cqc.org.uk/sites/default/files/media/documents/essentialstandards_of_quality_and_safety_march_2010_final_0.pdf Accessed August 1, 2013.
4. National Institute for Health and Care Excellence . Guidance 36. Prevention and control of healthcare-associated infections. Quality Improvement guide . London: National Institute for Health and Care Excellence; 2011; Available at: www.nice.org.uk/guidance/PH36 Accessed July 25, 2013.
5. Nseir S , Blazejewski C , Lubret R , Wallet F , Courcol R , Durocher A . Risk of acquiring multidrug-resistant Gram-negative bacilli from prior room occupants in the intensive care unit. *Clin Microbiol Infect* . 2011;17:1201-1208
6. Shaughnessy MK , Micielli RL , DePestel DD , et al. Evaluation of hospital room assignment and acquisition of *Clostridium difficile* infection . *Infect Control Hosp Epidemiol* . 2011;32:201-206
7. Wilson AP , Smyth D , Moore G , et al. The impact of enhanced cleaning within the intensive care unit on contamination of the near-patient environment with hospital pathogens: a randomized crossover study in critical care units in two hospitals . *Crit Care Med* . 2011;39:651-658
8. Kundrapu S , Sunkesula V , Jury LA , Sitzlar BM , Donskey CJ . Daily disinfection of high-touch surfaces in isolation rooms to reduce contamination of healthcare workers' hands . *Infect Control Hosp Epidemiol* . 2012;33:1039-1042

9. Otter JA , Yezli S , Perl TM , Barbut F , French GL . The role of 'no-touch' automated room disinfection systems in infection prevention and control . J Hosp Infect . 2013;83:1-13
10. Fu TY , Gent P , Kumar V . Efficacy, efficiency and safety aspects of hydrogen peroxide vapour and aerosolized hydrogen peroxide room disinfection systems . J Hosp Infect. 2012;80:199-205

Rev. n° 0 del 01.06.2014

11. Passaretti CL , Otter JA , Reich NG , et al. An evaluation of environmental decontamination with hydrogen peroxide vapor for reducing the risk of patient acquisition of multidrug-resistant organisms . *Clin Infect Dis* . 2013;56:27-35
12. Schmidt MG , Cantey JR , Freeman KD , et al. Sustained reduction of microbial burden on common hospital surfaces through introduction of copper . *J Clin Microbiol* . 2012;50:2217-2223
13. Schmidt MG , Ataway HH , Fahey SE , Steed LL , Michels HT , Salgado CD . Copper continuously limits the concentration of bacteria resident on bed rails within the intensive care unit . *Infect Control Hosp Epidemiol* . 2013;34:530-533
14. Karpanen TJ , Casey AL , Lambert PA , et al. The antimicrobial efficacy of copper alloy furnishing in the clinical environment: a crossover study . *Infect Control Hosp Epidemiol* . 2012;33:3-9
15. Salgado CD , Sepkowitz KA , John JF , et al. Copper surfaces reduce the rate of healthcare-acquired infections in the intensive care unit. *Infect Control Hosp Epidemiol* . 2013;34:479-486
16. Mulvey D , Redding P , Robertson C , et al. Finding a benchmark for monitoring hospital cleanliness . *J Hosp Infect* . 2011;77:25-30
17. National Clinical Guideline Centre . Infection: prevention and control of healthcare-associated infections in primary and community care: partial update of NICE Clinical Guideline 2. NICE Clinical Guidelines, No. 139 . London: Royal College of Physicians; 2012;
18. Gould DJ , Moralejo D , Drey N , Chudleigh JH . Interventions to improve hand hygiene compliance in patient care . *Cochrane Database Syst Rev* . 2011;8:CD005186.
19. Chen Y , Sheng W , Wang J , et al. Effectiveness and limitations of hand hygiene promotion on decreasing healthcare-associated infections . *PLoS One* . 2011;6:e27163
20. Chow A , Arah OA , Chan S , et al. Alcohol handrubbing and chlorhexidine handwashing protocols for routine hospital practice: a randomized clinical trial of protocol efficacy and time effectiveness . *Am J Infect Control* . 2012;40:800-805
21. Department of Health . Infection control in the built environment. Health Building Note 00-09. London: Department of Health; 2013; Huang C , Ma W , Stack S . The hygienic efficacy of different hand-drying methods: a review of the evidence . *Mayo Clin Proc* . 2012;87:791-798
22. Grayson ML , Russo PL , Cruickshank M , et al. Outcomes from the first 2 years of the Australian national hand hygiene initiative . *Med J Aust* . 2011;195:615-619
23. Cherry MG , Brown JM , Bethell GS , Neal T , Shaw NJ . Features of educational interventions that lead to compliance with hand hygiene in healthcare professionals within a hospital care setting. A BEME systematic review: BEME Guide No. 22 . *Med Teach* . 2012;34:e406-e420

24. Huis A , Holleman G , van Achterberg T , Grol R , Schoonhoven L , Hulscher M . Explaining the effects of two different strategies for promoting hand hygiene in hospital nurses: a process evaluation alongside a cluster randomised controlled trial . *Implement Sci* . 2013;8:41

Rev. n° 0 del 01.06.2014

25. Fuller C , Duckworth G , Jeanes A , et al. The Feedback Intervention Trial (FIT) - improving hand-hygiene compliance in UK healthcare workers: a stepped wedge cluster randomised controlled trial . PLoS One . 2012;7:e41617
26. Stone SP , Jeanes A , Roberts J , et al. Evaluation of the national Cleanyourhands campaign to reduce Staphylococcus aureus bacteraemia and Clostridium difficile infection in hospitals in England and Wales by improved hand hygiene: four year, prospective, ecological, interrupted time series study . BMJ . 2012;3:e3005
27. Benning A , Carmalt M , Rudge G , et al. Multiple component patient safety intervention in English hospitals: controlled evaluation of second phase . BMJ . 2011;342:d199
28. Savage J , Fuller C , Besser S , Stone S . Use of alcohol hand rub (AHR) at ward entrances and use of soap and AHR by patients and visitors: a study in 27 wards in nine acute NHS trusts . J Infect Prev . 2011;12:54-58
29. Health and Safety Executive . Personal protective equipment (PPE) at work: a brief guide. INDG174 (rev2). London: HSE Books; 2013; Available at: <http://www.hse.gov.uk/pubns/indg174.pdf> Accessed June 5, 2013.
30. Royal College of Nursing . Tools of the trade; RCN guidance for healthcare staff on glove use and prevention of contact dermatitis . London: Royal College of Nursing; 2012; Available at: http://www.rcn.org.uk/data/assets/pdf_file/0003/450507/RCNguidance_glovesdermatitis_WEB2.pdf Accessed July 22, 2013.
31. Health and Safety Executive . Selecting latex gloves . London: HSE Books; 2013; Available at: <http://www.hse.gov.uk/skin/employ/latex-gloves.htm> Accessed July 25, 2013. Health and Safety Executive . Choosing the right gloves to protect skin: a guide for employers . London: HSE Books; 2013; Available at: <http://www.hse.gov.uk/skin/employ/gloves.htm> Accessed July 25, 2013.
32. Fuller C , Savage J , Besser S , et al. "The dirty hand in the latex glove": a study of hand hygiene compliance when gloves are worn . Infect Control Hosp Epidemiol . 2011;32:1194-1199
33. Eveillard M , Guilloteau V , Kempf M , et al. Impact of improving glove usage on the hand hygiene compliance . Am J Infect Control . 2011;39:608-610
34. Eveillard M , Raymond F , Joly-Guillou M , et al. Measurement of hand hygiene compliance and gloving practices in different settings for the elderly considering the location of hand hygiene opportunities during patient care . Am J Infect Control . 2011;39:339-341
35. Huskins WC , Samore M , Wallace D , et al. Intervention to reduce transmission of resistant bacteria in intensive care . N Engl J Med . 2011;364:1407-1418

36. Department of Health . Health Technical Memorandum 07-01: safe management of healthcare waste . London: Department of Health; 2013;
37. Nye KJ , Leggett VA , Watterson L . Provision and decontamination of uniforms in the NHS . Nurs Stand . 2005;19:41-45

Rev. n° 0 del 01.06.2014

50. Murphy C , Fader M , Prieto J . Interventions to minimise the initial use of indwelling urinary catheters in acute care: a systematic review . *Int J Nurs Stud* . 2013;in press.
51. O'Grady NP , Pearson ML , Raad II , et al. Guidelines for the prevention of intravascular catheter-related infections . *Clin Infect Dis* . 2011;52:e162-e193

Rev. n° 0 del 01.06.2014

64. Webster J , Osborne S , Rickard C , New K . Clinically-indicated replacement versus routine replacement of peripheral

65. Simmons S , Bryson C , Porter S . 'Scrub the hub': cleaning duration and reduction in bacterial load on
central venous catheters . Crit Care Nurs Q .2011;34:33 -----■-----

Rev. n° 0 del 01.06.2014

Rev. n° 0 del 01.06.2014