

PULSION Medical Systems CeVOX-Technology Literature list

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- Very Highly Recommended
- Highly Recommended
- Recommended

'This document is intended to provide information to an international audience outside of the USA'

1. REVIEWS

Tanczos K & Molnar Z

The oxygen supply-demand balance: A monitoring challenge

Best Pract Res Clin Anaesthesiol 2013; 27(2): 201-7

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Ducrocq N, Kimmoun A, Levy B

LACTATE or ScvO₂ as an endpoint in resuscitation of shock states?

Minerva Anesthesiol 2013; 79(9): 1049-58

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Reid M

Central venous oxygen saturation: analysis, clinical use and effects on mortality

Nurs Crit Care 2013; 18(5): 245-50

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Walley KR.

Use of Central Venous Oxygen Saturation to Guide Therapy

Am J Respir Crit Care Med 2011;184:514-20

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Bauer P, Reinhart K, Bauer M.

Early goal directed therapy and outcome in septic shock

Int J Intensive Care 2007; Autumn:19-24

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Marx G, Reinhart K.

Venous oximetry

Curr Opin Crit Care 2006; 12:263-8

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Goodrich C.

Continuous central venous oximetry monitoring

Crit Care Nurs Clin North Am 2006; 18:203-9

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Rivers EP, Ander DS, Powell D.

Central venous oxygen saturation monitoring in the critically ill patient

Curr Opin Crit Care 2001; 7:204-11

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2. GUIDELINES AND STANDARD OPERATING PROCEDURES

Reinhart K, Brunkhorst FM et al.

[Prevention, diagnosis, treatment, and follow-up care of sepsis. First revision of the S2k Guidelines of the German Sepsis Society (DSG) and the German Interdisciplinary Association for Intensive and Emergency Care Medicine (DIVI)].

Ger Med Sci 2010; Doc 14

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Dellinger RP, Levy MM, Carlet JM, Bion J, Parker MM, Jaeschke R, Reinhart K, Angus DC, Brun-Buisson C, Beale R, Calandra T, Dhainaut JF, Gerlach H, Harvey M, Marini JJ, Marshall J, Ranieri M, Ramsay G, Sevransky J, Thompson BT, Townsend S, Vender JS, Zimmerman JL, Vincent JL.

Surviving Sepsis Campaign: International guidelines for management of severe sepsis and septic shock: 2008

Intensive Care Med 2008; 34(1): 17-60

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De Oliveira CF, de Oliveira DS, Gottschald AF, Moura JD, Costa GA, Ventura AC, Fernandes JC, Vaz FA, Carcillo JA, Rivers EP, Troster EJ.

ACCM / PALS haemodynamic support guidelines for paediatric septic shock: an outcomes comparison with and without monitoring central venous oxygen saturation

ICM 2008; 34 (6): 1065-75

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Carl M, Alms A, Braun J, Dongas A, Erb J, Goetz A, Goepfert M, Gogarten W, Grosse J, Heller A, Heringlake M, Kastrup M, Kroener A, Loer S, Marggraf G, Markewitz A, Reuter M, Schmitt DV, Schirmer U, Wiesenack C, Zwissler B, Spies C.

S3 Guidelines for Intensive Care in Cardiac Surgery Patients: Haemodynamic Monitoring and Circulatory system

Ger Med Sci 2010; 8: Doc 12

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Trzeciak S, Dellinger RP, Abate NL, Cowan RM, Stauss M, Kilgannon JH, Zanotti S, Parrillo JE.

Translating research to clinical practice: a 1-year experience with implementing early goal-directed therapy for septic shock in the emergency department

Chest 2006; 129:225-32

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3. OUTCOME PAPERS

Smetkin AA, Kirov M, Kuzkov VV, Lenkin AI, Eremeev AV, Slastilin VY, Borodin VV, Bjertnaes LJ.

Single transpulmonary thermodilution and continuous monitoring of central venous oxygen saturation during off-pump coronary surgery.

Acta Anaesthesiol Scand 2009; 53:505-14

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Csontos C, Foldi V, Fischer T, Bogar L.

Arterial thermodilution in burn patients suggests a more rapid fluid administration during early resuscitation.

Acta Anaesthesiol Scand 2008; 52(6): 742-9

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de Oliveira CF, de Oliveira DS, Gottschald AF, Moura JD, Costa GA, Ventura AC, Fernandes JC, Vaz FA, Carcillo JA, Rivers EP, Troster EJ.

ACCM/PALS haemodynamic support guidelines for paediatric septic shock: an outcomes comparison with and without monitoring central venous oxygen saturation.

Intensive Care Med 2008; 34(6): 1065-75.

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Kortgen A, Niederprün P, Bauer M.

Implementation of an evidence-based „standard operating procedure“ and outcome in septic shock

Crit Care Med 2006; 34(4):943-9

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Rivers ER, Nguyen B, Havstad S, Ressler J, Muzzin A, Knoblich B, Peterson E, Tomlanovich M.

Early goal-directed therapy in the treatment of severe sepsis and septic shock

N Eng J Med 2001; 345:1368–7

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4. METHODOLOGY AND VALIDATION

4.1 ScvO₂ vs. SvO₂

el-Masry A, Mukhtar MA, el-Sherbeny AM, Fathy M, el-Meteini M

Comparison of central venous oxygen saturation and mixed venous oxygen saturation during liver transplantation

Anaesthesia 2009; 64(4): 378-82

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Kopterides P, Bonovas S, Mavrou I, Kostadima E, Zakyntinos E, Armaganidis AS.
Venous Oxygen Saturation and Lactate Gradient from Superior Vena Cava to Pulmonary Artery in Patients with Septic Shock
Shock 2009; 31(6): 561-7

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Sander M, Spies CD, Foer A, Weymann L, Braun J, Volk T, Grubitzsch H, von Heymann C.
Agreement of central venous saturation and mixed venous saturation in cardiac surgery patients
Intensive Care Med 2007; 33(10): 1719-25

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Reinhart K, Kuhn HJ, Hartog C, Bredle DL.
Continuous central venous and pulmonary artery oxygen saturation monitoring in the critically ill
Curr Opin Crit Care 2004; 30:1572-8

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Ladakis C, Myrianthefs P, Karabinis A, Karatzas G, Dosios T, Fildissis G, Gogas J, Baltopoulos G.
Central venous and mixed venous oxygen saturation in critically ill patients
Respiration 2001; 68:279-85

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4.2 Continuous ScvO₂

Hofer CK, Ganter M, Fodor P, Tavakoli R, Genoni M, Zollinger A.
Continuous central venous oxygenation measurement by CeVOX in patients undergoing off-pump coronary bypass grafting
Crit Care 2006:P340

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Rivers ER, Nguyen B, Havstad S, Ressler J, Muzzin A, Knoblich B, Peterson E, Tomlanovich M.
Early goal-directed therapy in the treatment of severe sepsis and septic shock
N Eng J Med 2001; 345:1368-7

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Rady MY, Rivers EP, Martin GB, Smithline H, Appelton T, Nowak RM.
Continuous central venous oximetry and shock index in the emergency department: use in the evaluation of clinical shock
Am J Emerg Med 1992; 10:538-41

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4.3 CeVOX Validation

Molnar Z, Umgelter A, Toth I, Livingstone D, Weyland A, Sakka SG, Meier-Hellmann A.
Continuous monitoring of ScvO₂ by a new fibre-optic technology compared with blood gas oximetry in critically ill patients: a multicentre study
Intensive Care Med 2007; 33(10): 1767-70

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Muller M, Lohr T, Scholz S, Thul J, Akinturk H, Hempelmann G.
Continuous SvO₂ measurement in infants undergoing congenital heart surgery - first clinical experiences with a new fiberoptic probe
Paediatr Anaesth. 2007; 17(1):51-5.

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Ducart A, Dejonckheere M, Koch M, Perrin L, Schmartz D.
Continuous central venous and pulmonary artery oxygen saturation monitoring in cardiac surgery after cardiopulmonary bypass
Eur J Anaesthesiol 2007; 4AP2-7

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Huber D, Osthaus W, Optenhöfel J, Breymann T, Marx G, Piepenbrock S, Sümpelmann R.

Continuous monitoring of central venous oxygen saturation in neonates and small infants: in vitro evaluation of two different oximetry catheters

Paediatr Anaesth 2006; 16(12):1257-61

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Hofer CK, Ganter M, Fodor P, Tavakoli R, Genoni M, Zollinger A.

Continuous central venous oxygenation measurement by CeVOX in patients undergoing off-pump coronary bypass grafting

Crit Care 2006:P340

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4.4 ScvO₂ and Blood Gas Analysis Cost Comparison

Bloos F, Rissner F, Specht M, Reinhart K, Marx G

Costs of intermittent measurement of central venous oxygen saturations by blood gas analysis

Intensive Care Med 2009; 35(7): 1316-7

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5. FIELDS OF APPLICATION

5.1 Septic Shock

Shin TG, Jo IJ, Hwang SY, Jeon K, Suh GY, Choe E, Lee YK, Lee TR, Cha WC, Sim MS

Comprehensive Interpretation of Central Venous Oxygen Saturation and Blood Lactate Levels During Resuscitation of Patients With Severe Sepsis and Septic Shock in the Emergency Department

Shock 2016; 45(1): 4-9

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Park JH, Lee J, Park YS, Lee CH, Lee SM, Yim JJ, Kim YW, Han SK, Yoo CG

Prognostic Value of Central Venous Oxygen Saturation and Blood Lactate Levels Measured Simultaneously in the Same Patients with Severe Systemic Inflammatory Response Syndrome and Severe Sepsis

Lung 2014; 192(3): 435-40

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Maddirala S and Khan A

Optimizing hemodynamic support in septic shock using central and mixed venous oxygen saturation

Crit Care Clin 2010; 26(2): 323-33

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Pope JV, Jones AE, Gaieski DF, Arnold RC, Trzeciak S, Shapiro NI

Multicenter Study of Central Venous Oxygen Saturation (ScvO₂) as a Predictor of Mortality in Patients With Sepsis

Ann Emerg Med 2010; 55(1): 40-6

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Nguyen HB, Corbett SW, Steele R, Banta J, Clark RT, Hayes SR, Edwards J, Cho TW, Wittlake WA.

Implementation of a bundle of quality indicators for the early management of severe sepsis and septic shock is associated with decreased mortality

Crit Care Med 2007; 35 (4): 1105 - 12

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Kortgen A, Niederprün P, Bauer M.

Implementation of an evidence-based „standard operating procedure“ and outcome in septic shock

Crit Care Med 2006; 34(4):939-9

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Trzeciak S, Dellinger RP, Abate NL, Cowan RM, Stauss M, Kilgannon JH, Zanotti S, Parrillo JE.

Translating research to clinical practice: a 1-year experience with implementing early goal-directed therapy for septic shock in the emergency department

Chest 2006;129: 225-32

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Early goal-directed therapy in the treatment of severe sepsis and septic shock

N Eng J Med 2001; 345:1368–77

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5.2 Cardiogenic Shock and Cardiopulmonary Resuscitation

Chin K, Channick RN, Kim NH, Rubin LJ.

Central venous blood oxygen saturation monitoring in patients with chronic pulmonary arterial hypertension treated with continuous IV epoprostenol: correlation with measurements of hemodynamics and plasma brain natriuretic peptide levels.

Chest 2007; 132(3): 786-92.

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Ander DS, Jaggi M, Rivers E, Rady MY, Levine TB, Levine AB, Masura J, Gryzbowski M.

Undetected cardiogenic shock in patients with congestive heart failure presenting to the emergency department

Am J Cardiol 1998; 82:888-91

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Rivers EP, Martin GB, Smithline H, Rady MY, Schultz CH, Goetting MG, Appleton TJ, Nowak RM.

The clinical implications of continuous central venous oxygen saturation during human CPR

Ann Emerg Med 1992; 21:1094-1101

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Rivers EP, Rady MY, Martin GB, Fenn NM, Smithline HA, Alexander ME, Nowak RM.

Venous hyperoxia after cardiac arrest. Characterization of a defect in systemic oxygen utilization

Chest. 1992; 102(6):1787-93

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5.3 Emergency Medicine

Trzeciak S, Dellinger RP, Abate NL, Cowan RM, Stauss M, Kilgannon JH, Zanotti S, Parrillo JE.

Translating research to clinical practice: a 1-year experience with implementing early goal-directed therapy for septic shock in the emergency department

Chest 2006; 129:225-32

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Rivers E, Nguyen B, Havstad S, Ressler J, Muzzin A, Knoblich B, Peterson E, Tomlanovich M.

Early goal-directed therapy in the treatment of severe sepsis and septic shock

N Eng J Med 2001; 345:1368–77

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Rady MY, Rivers EP, Nowak RM.

Resuscitation of the critically ill in the ED: responses of blood pressure, heart rate, shock index, central venous oxygen saturation, and lactate

Am J Emerg Med 1996; 14:218-25

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5.4 Cardiac Surgery

Balzer F, Sander M, Simon M, Spies C, Habicher M, Treskatsch S, Mezger V, Schirmer U, Heringlake M, Wernecke KD, Grubitzsch H, von Heymann C

High central venous saturation after cardiac surgery is associated with increased organ failure and long-term mortality: an observational cross-sectional study

Crit Care 2015; 19(1): 168

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Gasparovic H, Gabelica R, Ostojic Z, Kopjar T, Petricevic M, Ivancan V, Biocina B

Diagnostic accuracy of central venous saturation in estimating mixed venous saturation is proportional to cardiac performance among cardiac surgical patients

J Crit Care 2014; 29(5): 828-34

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Hu BY, Laine GA, Wang S, Solis RT

Combined central venous oxygen saturation and lactate as markers of occult hypoperfusion and outcome following cardiac surgery

J Cardiothorac Vasc Anesth 2012; 26(1): 52-7.

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Perz S, Uhlig T, Kohl M, Bredle DL, Reinhart K, Bauer M, Kortgen A.

Low and "supranormal" central venous oxygen saturation and markers of tissue hypoxia in cardiac surgery patients: a prospective observational study.

Intensive Care Med 2011; 1: 52-9

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Nogueira PM, Mendonca-Filho MT, Campos LA, Gomes RV, Felipe AR, Fernandes MA, Villela-Nogueira CA, Rocco JR.

Central Venous Saturation: A Prognostic Tool in Cardiac Surgery Patients

J Intensive Care Med 2010; 25(2): 111-6

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Smetkin AA, Kirov M, Kuzkov VV, Lenkin AI, Ereemeev AV, Slastilin VY, Borodin VV, Bjertnaes LJ.

Single transpulmonary thermodilution and occlusive monitoring of central venous oxygen saturation during off-pump coronary surgery.

Acta Anaesthesiol Scand 2009; 53: 505-14

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5.5 General Surgery

Mikor A, Trasy D, Nemeth MF, Osztruczki A, Kocsi S, Kovacs I, Demeter G, Molnar Z

Continuous central venous oxygen saturation assisted intraoperative hemodynamic management during major abdominal surgery: a randomized, controlled trial

BMC Anesthesiol 2015; 15: 82

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Meguro M, Mizuguchi T, Kawamoto M, Nakamura Y, Ota S, Kukita K, Ishii M, Tatsumi H, Hirata K

Continuous monitoring of central venous oxygen saturation predicts postoperative liver dysfunction after liver resection

Surgery 2013; 154(2): 351-62

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Jakob S.

Multicentre study on peri-postoperative central venous oxygen saturation in high-risk surgical patients

Critical Care 2006; 10:R158

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Pearse R, Dawson D, Fawcett J, Rhodes A, Grounds RM, Bennett ED.

Changes in central venous saturation after major surgery, and association with outcome

Crit Care 2005; 9:R694-9

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5.6 Paediatrics (off label use)

de Oliveira CF, de Oliveira DS, Gottschald AF, Moura JD, Costa GA, Ventura AC, Fernandes JC, Vaz FA, Carcillo JA, Rivers EP, Troster EJ.

ACCM/PALS haemodynamic support guidelines for paediatric septic shock: an outcomes comparison with and without monitoring central venous oxygen saturation.

Intensive Care Med 2008; 34(6): 1065-75.

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Seear MD, Scarfe JC, Leblanc JG.

Predicting major adverse events after cardiac surgery in children

Pediatr Crit Care Med 2008; 9(6): 606-11

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Muller M, Lohr T, Scholz S, Thul J, Akinturk H, Hempelmann G.

Continuous SvO₂ measurement in infants undergoing congenital heart surgery - first clinical experiences with a new fiberoptic probe

Paediatr Anaesth. 2007; 17(1):51-5.

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Osthaus WA, Huber D, Beck C, Roehler A, Marx G, Hecker H, Sümpelmann R.

Correlation of oxygen delivery with central venous oxygen saturation, mean arterial pressure and heart rate in piglets

Paediatr Anaesth. 2006; 16(9):944-7.

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Huber D, Osthaus W, Optenhöfel J, Breyman T, Marx G, Piepenbrock S, Sümpelmann R.

Continuous monitoring of central venous oxygen saturation in neonates and small infants: in vitro evaluation of two different oximetry catheters

Paediatr Anesth. 2006; 16(12):1257-61

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5.7 ScvO₂ As Indicator For Blood Transfusion

Krantz T, Warberg J, Secher NH.

Venous oxygen saturation during normovolaemic haemodilution in the pig

Acta Anaesthesiol Scand 2005; 49:1149-56

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Schou H, Perez de Sa V, Larsson A.

Central and mixed venous blood oxygen correlate well during acute normovolemic hemodilution in anesthetized pigs

Acta Anaesthesiol Scand 1998; 42:172-7

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5.8 Burns

Csontos C, Foldi V, Fischer T, Bogar L.

Arterial thermodilution in burn patients suggests a more rapid fluid administration during early resuscitation.

Acta Anaesthesiol Scand 2008; 52(6): 742-9

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5.9 Medical

Giraud R, Siegenthaler N, Gayet-Ageron A, Combescure C, Romand JA, Bendjelid K.

ScvO₂ As a Marker to Define Fluid Responsiveness

J Trauma 2011;70(4): 802-7

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Jansen TC, van Bommel J, Schoonderbeek J, Sleswijk Visser SJ, van der Klooster JM, Lima AP, Willemsen SP, Bakker J

Early Lactate-Guided Therapy in ICU Patients: A Multicenter, Open-Label, Randomized, Controlled Trial.

Am J Respir Crit Care Med 2010; 182: 752-61

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6. RISK ANALYSIS OF CENTRAL VENOUS CATHETERISATION

Gowardman JR, Robertson IK, Parkes S, Rickard CM

Influence of insertion site on central venous catheter colonization and bloodstream infection rates.

Intensive Care Med 2008 34(6): 1038-1045.

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Crowley AL, Peterson GE, Benjamin DK Jr, Rimmer SH, Todd C, Cabell CH, Reller LB, Ryan T, Corey GR, Fowler VG Jr.

Venous thrombosis in patients with short- and long-term central venous catheter-associated Staphylococcus aureus bacteremia

Crit Care Med 2008; 36(2): 385-90

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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(2): 397-402

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Schummer W, Schummer C, Rose N, Niesen WD, Sakka SG.

Mechanical complications and malpositions of central venous cannulations by experienced operators: A prospective study of 1794 catheterizations in critically ill patients

Intensive Care Medicine 2007; 33(6):1055-9

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Eisen LA, Narasimhan M, Berger JS, Mayo PH, Rosen MJ, Schneider RF.

Mechanical complications of central venous catheters

J Int Care Med 2006; 21 (1): 40-6

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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(6):1276-80

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