

Supplement 3. Database search strategies

1. Central venous catheter insertion site and complications

A) Infection

Update based on: Arvaniti K, Lathyris D, Blot S, Apostolidou-Kiouti F, Koulenti D, Haidich AB.

Cumulative evidence of randomized controlled and observational studies on catheter-related infection risk of central venous catheter insertion site in ICU patients: a pairwise and network meta-analysis. Crit Care Med. 2017;45(4):e437–e448. doi:10.1097/CCM.0000000000002092.

PubMed: ((infection[Title/Abstract] OR coloni*[Title/Abstract] AND (central line*[Title/Abstract] OR central venous line*[Title/Abstract] OR central venous cath*[Title/Abstract] OR central venous cannul*[Title/Abstract] OR central vein[Title/Abstract] OR femoral[Title/Abstract] OR axillary[Title/Abstract] OR subclavian[Title/Abstract] OR internal jugular[Title/Abstract])) AND (randomized controlled trial[Title/Abstract] OR controlled clinical trial[Title/Abstract] OR prospective[Title/Abstract] OR RCT[Title/Abstract] OR trial[Title/Abstract]) AND (2016:2024[pdat]))

EMBASE: (infection:ti,ab,kw OR coloni*:ti,ab,kw) AND ('central line*':ti,ab,kw OR 'central venous line*':ti,ab,kw OR 'central venous cath*':ti,ab,kw OR 'central venous cannul*':ti,ab,kw OR 'central vein':ti,ab,kw OR femoral:ti,ab,kw OR axillary:ti,ab,kw OR subclavian:ti,ab,kw OR 'internal jugular':ti,ab,kw) AND ('randomized controlled trial':ti,ab,kw OR 'controlled clinical trial':ti,ab,kw OR prospective:ti,ab,kw OR rct:ti,ab,kw OR trial:ti,ab,kw) AND [2017-2024]/py

Cochrane Library: infection OR coloni* in Title Abstract Keyword AND central line* OR central venous line* OR central venous cath* OR central venous cannul* OR central vein OR femoral OR axillary OR subclavian OR internal jugular in Title Abstract Keyword AND randomized controlled trial OR controlled clinical trial OR prospective OR RCT OR trial in Title Abstract Keyword

B) Thromboembolic events

Update based on: Sakuraya M, Okano H, Yoshihiro S, Niida S, Kimura K. Insertion site of central venous catheter among hospitalized adult patients: a systematic review and network meta-analysis. Front Med (Lausanne). 2022;9:960135. doi:10.3389/fmed.2022.960135.

PubMed: ((thromb*[Title/Abstract] OR fibrin*[Title/Abstract] OR occlu*[Title/Abstract] OR block*[Title/Abstract] OR stenos*[Title/Abstract] OR clot*[Title/Abstract]) AND (central line*[Title/Abstract] OR central venous line*[Title/Abstract] OR central venous cath*[Title/Abstract] OR central venous cannul*[Title/Abstract] OR central vein[Title/Abstract] OR femoral[Title/Abstract] OR axillary[Title/Abstract] OR subclavian[Title/Abstract] OR internal jugular[Title/Abstract])) AND ((randomized controlled trial[Title/Abstract] OR controlled clinical trial[Title/Abstract] OR prospective[Title/Abstract] OR RCT[Title/Abstract] OR trial[Title/Abstract]))

EMBASE: (thromb*:ti,ab,kw OR fibrin*:ti,ab,kw OR occlu*:ti,ab,kw OR block*:ti,ab,kw OR stenos*:ti,ab,kw OR clot*:ti,ab,kw) AND ('central line*':ti,ab,kw OR 'central venous line*':ti,ab,kw OR 'central venous

cath*:ti,ab,kw OR 'central venous cannul*':ti,ab,kw OR 'central vein':ti,ab,kw OR femoral:ti,ab,kw OR axillary:ti,ab,kw OR subclavian:ti,ab,kw OR 'internal jugular':ti,ab,kw) AND ('randomized controlled trial':ti,ab,kw OR 'controlled clinical trial':ti,ab,kw OR prospective:ti,ab,kw OR rct:ti,ab,kw OR trial:ti,ab,kw) AND [2022-2024]/py

Cochrane Library: thromb* OR fibrin* OR occlu* OR block* OR stenosis* OR clot* in Title Abstract Keyword AND central line* OR central venous line* OR central venous cath* OR central venous cannul* OR central vein OR femoral OR axillary OR subclavian OR internal jugular in Title Abstract Keyword AND randomized controlled trial OR controlled clinical trial OR prospective OR RCT OR trial in Title Abstract Keyword

C) Mechanical complications

Update based on: Sakuraya M, Okano H, Yoshihiro S, Niida S, Kimura K. Insertion site of central venous catheter among hospitalized adult patients: a systematic review and network meta-analysis. *Front Med (Lausanne)*. 2022;9:960135. doi:10.3389/fmed.2022.960135.

PubMed: ((mechanical complicat*[Title/Abstract] OR mechanical trauma[Title/Abstract] OR arterial puncture[Title/Abstract] OR arterial cannul*[Title/Abstract] OR arterial injur*[Title/Abstract] OR nerve injur*[Title/Abstract] OR bleeding[Title/Abstract] OR hemorrhage[Title/Abstract] OR pneumothorax[Title/Abstract] OR perforat*[Title/Abstract]) AND (central line*[Title/Abstract] OR central venous line*[Title/Abstract] OR central venous cath*[Title/Abstract] OR central venous cannul*[Title/Abstract] OR central vein[Title/Abstract] OR femoral[Title/Abstract] OR axillary[Title/Abstract] OR subclavian[Title/Abstract] OR internal jugular[Title/Abstract])) AND (randomized controlled trial[Title/Abstract] OR controlled clinical trial[Title/Abstract] OR prospective[Title/Abstract] OR RCT[Title/Abstract] OR trial[Title/Abstract])

EMBASE: ('mechanical complicat*':ti,ab,kw OR 'mechanical trauma':ti,ab,kw OR 'arterial puncture':ti,ab,kw OR 'arterial cannul*':ti,ab,kw OR 'arterial injur*':ti,ab,kw OR 'nerve injur*':ti,ab,kw OR bleeding:ti,ab,kw OR hemorrhage:ti,ab,kw OR pneumothorax:ti,ab,kw OR perforat*:ti,ab,kw) AND ('central line*':ti,ab,kw OR 'central venous line*':ti,ab,kw OR 'central venous cath*':ti,ab,kw OR 'central venous cannul*':ti,ab,kw OR 'central vein':ti,ab,kw OR femoral:ti,ab,kw OR axillary:ti,ab,kw OR subclavian:ti,ab,kw OR 'internal jugular':ti,ab,kw) AND ('randomized controlled trial':ti,ab,kw OR 'controlled clinical trial':ti,ab,kw OR prospective:ti,ab,kw OR rct:ti,ab,kw OR trial:ti,ab,kw) AND [2022-2024]/py

Cochrane Library: mechanical complicat* OR mechanical trauma OR arterial puncture OR arterial cannul* OR arterial injur* OR nerve injur* OR bleeding OR hemorrhage OR pneumothorax OR perforat* in Title Abstract Keyword AND central line* OR central venous line* OR central venous cath* OR central venous cannul* OR central vein OR femoral OR axillary OR subclavian OR internal jugular in Title Abstract Keyword AND randomized controlled trial OR controlled clinical trial OR prospective OR RCT OR trial

2. Use of ultrasound during central venous cannulation (internal jugular and femoral veins)

Update based on: Brass P, Hellmich M, Kolodziej L, Schick G, Smith AF. Ultrasound guidance versus anatomical landmarks for internal jugular vein catheterization. *Cochrane Database Syst Rev.* 2015;1(1):CD006962. doi:10.1002/14651858.CD006962.pub2.

and: Brass P, Hellmich M, Kolodziej L, Schick G, Smith AF. Ultrasound guidance versus anatomical landmarks for subclavian or femoral vein catheterization. *Cochrane Database Syst Rev.* 2015;1(1):CD011447. doi:10.1002/14651858.CD011447.

PubMed: (((internal jugular[Title/Abstract] OR jugular[Title/Abstract] OR femoral[Title/Abstract]) AND (ultrasound[Title/Abstract] OR US[Title/Abstract] OR ultrasonic[Title/Abstract])) AND (central line*[Title/Abstract] OR insertion*[Title/Abstract] OR cannulation[Title/Abstract] OR access[Title/Abstract] OR catheter*[Title/Abstract] OR puncture[Title/Abstract] OR venous[Title/Abstract] OR vein*[Title/Abstract] OR central venous line*[Title/Abstract])) AND (randomized controlled trial[Title/Abstract] OR controlled clinical trial[Title/Abstract] OR prospective[Title/Abstract] OR RCT[Title/Abstract] OR trial[Title/Abstract])

EMBASE: ('internal jugular':ti,ab,kw OR jugular:ti,ab,kw OR femoral:ti,ab,kw) AND (ultrasound:ti,ab,kw OR us:ti,ab,kw OR ultrasonic:ti,ab,kw) AND ('randomized controlled trial':ti,ab,kw OR 'controlled clinical trial':ti,ab,kw OR prospective:ti,ab,kw OR rct:ti,ab,kw OR trial:ti,ab,kw) AND ('central line*':ti,ab,kw OR insertion*:ti,ab,kw OR cannulation:ti,ab,kw OR access:ti,ab,kw OR catheter*:ti,ab,kw OR puncture:ti,ab,kw OR venous:ti,ab,kw OR vein*:ti,ab,kw OR 'central venous line*':ti,ab,kw) AND [2015-2024]/py

Cochrane Library: internal jugular OR jugular OR femoral in Title Abstract Keyword AND ultrasound OR US OR ultrasonic in Title Abstract Keyword AND randomized controlled trial OR controlled clinical trial OR prospective OR RCT OR trial in Title Abstract Keyword AND central line* OR insertion* OR cannulation OR access OR catheter* OR puncture OR venous OR vein* OR central venous line* in Title Abstract Keyword

3. Use of ultrasound during central venous cannulation (axillary / subclavian vein)

Based on: Zawadka M, La Via L, Wong A, et al. Real-time ultrasound guidance as compared with landmark technique for subclavian central venous cannulation: a systematic review and meta-analysis with trial sequential analysis. *Crit Care Med.* 2023;51(5):642–652. doi:10.1097/CCM.0000000000005819.

4. Routine post-insertion ultrasound assessment versus radiographic assessment (chest X-ray) after central venous catheter placement

Update based on: Smit JM, Raadsen R, Blans MJ, et al. Bedside ultrasound to detect central venous catheter misplacement and associated iatrogenic complications: a systematic review and meta-analysis. *Crit Care.* 2018;22:65. doi:10.1186/s13054-018-1989-x.

PubMed: ultrasound OR ultrasonic AND central line* OR central venous line* OR central venous cath* OR central venous cannul* OR central vein OR femoral OR axillary OR subclavian OR internal jugular AND radiography OR x-ray OR xray OR CXR or radiogram

EMBASE: (ultrasound:ti,ab,kw OR ultrasonic:ti,ab,kw) AND ('central line*':ti,ab,kw OR 'central venous line*':ti,ab,kw OR 'central venous cath*':ti,ab,kw OR 'central venous cannul*':ti,ab,kw OR 'central vein':ti,ab,kw OR femoral:ti,ab,kw OR axillary:ti,ab,kw OR subclavian:ti,ab,kw OR 'internal jugular':ti,ab,kw) AND (radiography:ti,ab,kw OR 'x ray':ti,ab,kw OR xray:ti,ab,kw OR cxr:ti,ab,kw OR radiogram:ti,ab,kw) AND [2017-2024]/py

Cochrane Library: ultrasound OR ultrasonic in Title Abstract Keyword AND central line* OR central venous line* OR central venous cath* OR central venous cannul* OR central vein OR femoral OR axillary OR subclavian OR internal jugular in Title Abstract Keyword AND radiography OR x-ray OR xray OR CXR or radiogram in Title Abstract Keyword

5. Patient positioning for central venous cannulation

A) Internal jugular vein

Based on: Garcia-Leal M, Guzman-Lopez S, Verdines-Perez AM, et al. Trendelenburg position for internal jugular vein catheterization: a systematic review and meta-analysis. *J Vasc Access*. 2023;24(2):338–347. doi:10.1177/11297298211031339.

B) Other veins

PubMed: (central vein[Title/Abstract] OR central access[Title/Abstract] OR central venous catheter[Title/Abstract] OR subclavian vein[Title/Abstract] OR axillary vein[Title/Abstract] OR femoral vein[Title/Abstract]) AND (body posture[Title/Abstract] OR horizontal position*[Title/Abstract] OR supine head-down[Title/Abstract] OR trendelenburg[Title/Abstract] OR flat of the back[Title/Abstract] OR reverse trendelenburg[Title/Abstract] OR feet elevated[Title/Abstract] OR head tilt down[Title/Abstract] OR supine[Title/Abstract] OR patient position*[Title/Abstract])

EMBASE: ('central vein':ti,ab,kw OR 'central access':ti,ab,kw OR 'central venous catheter':ti,ab,kw OR 'subclavian vein':ti,ab,kw OR 'axillary vein':ti,ab,kw OR 'femoral vein':ti,ab,kw) AND ('body posture':ti,ab,kw OR 'horizontal position*':ti,ab,kw OR 'supine head-down':ti,ab,kw OR trendelenburg:ti,ab,kw OR 'flat of the back':ti,ab,kw OR 'reverse trendelenburg':ti,ab,kw OR 'feet elevated':ti,ab,kw OR 'head tilt down':ti,ab,kw OR supine:ti,ab,kw OR 'patient position*':ti,ab,kw) AND [2000-2024]/py

Cochrane Library: central vein OR central access OR central venous catheter OR subclavian vein OR axillary vein OR femoral vein in Title Abstract Keyword AND body posture OR horizontal position* OR supine head-down OR trendelenburg OR flat of the back OR reverse trendelenburg OR feet elevated OR head tilt down OR supine OR patient position* in Title Abstract Keyword

C) Arm abduction

PubMed: (arm position* OR shoulder position* OR arm abduct* OR shoulder abduct* OR stop sign) AND (subclavian vein OR axillary vein)

EMBASE: ('arm position*':ti,ab,kw OR 'shoulder position*':ti,ab,kw OR 'arm abduct*':ti,ab,kw OR 'shoulder abduct*':ti,ab,kw OR 'stop sign':ti,ab,kw) AND ('subclavian vein':ti,ab,kw OR 'axillary vein':ti,ab,kw) AND [2000-2024]/py

Cochrane Library: arm position* OR shoulder position* OR arm abduct* OR shoulder abduct* OR stop sign in Title Abstract Keyword AND subclavian vein OR axillary vein in Title Abstract Keyword

6. Pre-procedural ultrasound assessment of the central vein

No systematic review was performed.

7. Ultrasound confirmation of intravascular guidewire position during central venous catheterization

No systematic review was performed.