# Appendix 1.

# SEARCH STRATEGY

**PICO 1.**

**Population/problem**Adult patients requiring a central venous access  **Intervention**Ultrasound-guided cannulation of internal jugular vein, axillary vein (also named subclavian vein), brachiocephalic vein **Comparators**Any other technique of central venous cannulation **Outcomes**Major complications (pneumothorax, arterial puncture, nerve injury, haemothorax)Minor complication (haematoma)Overall successFirst attempt successTime to cannulation **Situation**Any elective or emergency procedure

***PubMed***

"Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR "administration, intravenous"[MeSH Terms] OR access\*[Title/Abstract] OR canula\*[Title/Abstract] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract]

AND

 ("subclavian vein"[MeSH Terms] OR "Axillary vein"[MeSH Terms] OR "jugular veins"[MeSH Terms]) OR "Brachiocephalic Veins"[Mesh terms] OR (jugular\*[Text Word] OR axillar\*[Text Word] OR subclavian\*[Text Word] OR Brachiocephalic\*[Text Word])

AND

"ultrasonography"[MeSH Terms] OR "Ultrasonics"[Mesh Terms] OR (ultrasound\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR ultrason\*[Title/Abstract] OR echograph\*[Title/Abstract])

NOT (“animals"[MeSH Terms] not “humans"[MeSH Terms])

NOT (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]) not “adult” [MeSH Terms]

Filters: Publication date from 2005/01/01 to 2017/12/31

|  |  |
| --- | --- |
| Search ((((("Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR "administration, intravenous"[MeSH Terms] OR access\*[Title/Abstract] OR canula\*[Title/Abstract] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract])) AND (("subclavian vein"[MeSH Terms] OR "Axillary vein"[MeSH Terms] OR "jugular veins"[MeSH Terms]) OR "Brachiocephalic Veins"[Mesh terms] OR (jugular\*[Text Word] OR axillar\*[Text Word] OR subclavian\*[Text Word] OR Brachiocephalic\*[Text Word]))) AND ("ultrasonography"[MeSH Terms] OR "Ultrasonics"[Mesh Terms] OR (ultrasound\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR ultrason\*[Title/Abstract] OR echograph\*[Title/Abstract]))) NOT ((“animals"[MeSH Terms] not “humans"[MeSH Terms]))) NOT (((“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]) not “adult” [MeSH Terms])) Filters: Publication date from 2005/01/01 to 2017/12/31 | [1188](https://www.ncbi.nlm.nih.gov/pubmed/?cmd=HistorySearch&querykey=9) |

***Embase***

1 exp central venous catheter/ or exp central venous catheterization/ or exp intravenous drug administration/ or ((access\* adj10 (vein\* or venous or intravenous or vessel\*)) or can?ula\* or catheter\* or CVC).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading] (755899)  
2 exp subclavian vein/ or exp axillary vein/ or exp jugular vein/ or exp brachiocephalic vein/ or (jugular\* or axillar\* or subclavian\* or brachiocephalic\*).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading] (104946)  
3 exp echography/ or exp ultrasound/ or (ultrasound\* or ultra sound\* or ultrason\* or echograph\*).ti,ab. (849569)  
4 1 and 2 and 3 (4670)  
5 exp animal/ not exp human/ (4379191)  
6 4 not 5 (4491)  
7 exp juvenile/ not exp adult/ (2017542)  
8 6 not 7 (3878)  
9 limit 8 to yr="2005 -Current" (3136)

***Cochrane Library – Central***

#1 MeSH descriptor: [Central Venous Catheters] explode all trees 67

#2 MeSH descriptor: [Catheterization, Central Venous] explode all trees 845

#3 MeSH descriptor: [Administration, Intravenous] explode all trees 17023

#4 (access\* or can?ula\* or catheter\* or CVC) 39371

#5 #1 or #2 or #3 or #4 55426

#6 MeSH descriptor: [Subclavian Vein] explode all trees 104

#7 MeSH descriptor: [Axillary Vein] explode all trees 24

#8 MeSH descriptor: [Jugular Veins] explode all trees 235

#9 MeSH descriptor: [Brachiocephalic Veins] explode all trees 15

#10 (jugular\* or axillar\* or subclavian\* or Brachiocephalic\*) 4005

#11 #6 or #7 or #8 or #9 or #10 4005

#12 #5 and #11 1041

#13 MeSH descriptor: [Ultrasonography] explode all trees 9129

#14 MeSH descriptor: [Ultrasonics] explode all trees 298

#15 (ultrasound\* or ultra sound\* or ultrason\* or echograph\*) 26266

#16 #13 or #14 or #15 28369

#17 #12 and #16 307

#18 (paediatric\* or pediatric\* or child\* or infant\*) not (adult\* or aged or elderly) 80644

#19 #17 not #18 286

#20 #17 not #18 Publication Year from 2005 to 2016 222

141 are trials from Central, the rest are reviews from Cochrane Library.

***Cinahl***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S1 | (MH "Central Venous Catheters+") OR (MH "Catheterization, Central Venous+") OR (MH "Administration, Central Venous") |  |  | 4,467 |
| S2 | TX (access\* OR can\*ula\* OR catheter\* OR CVC) |  |  | 169,419 |
| S3 | S1 OR S2 |  |  | 169,425 |
| S4 | (MH "Subclavian Vein") OR (MH "Axillary Vein") OR (MH "Jugular Veins") OR (MH "Brachiocephalic Veins") |  |  | 969 |
| S5 | TX (jugular\* OR axillar\* OR subclavian\* OR Brachiocephalic\*) |  |  | 4,725 |
| S6 | S4 OR S5 |  |  | 4,725 |
| S7 | (MH "Ultrasonography+") OR (MH "Ultrasonics+") |  |  | 36,269 |
| S8 | TX (Ultrasound\* OR ultra sound\* OR ultrason\* OR echograph\*) |  |  | 47,976 |
| S9 | S7 OR S8 |  |  | 58,132 |
| S10 | S3 AND S6 AND S9 |  |  | 241 |
| S11 | (MH "Animals+") not (MH "Human") |  |  | 30,950 |
| S12 | S10 not S11 |  |  | 239 |
| S13 | (MH "Child+") not (MH "Adult+") |  |  | 255,856 |
| S14 | s12 not s13 |  |  | 223 |
| S15 | s12 not s13 Published: 20050101-20161231 |  |  | 176 |

**PICO 2**

**Population/problem**Adult patients requiring a femoral venous access for elective or emergency situations **Intervention**Ultrasound-guided cannulation of the femoral vein **Comparators**Any other technique of femoral vein cannulation **Outcomes**Major complications (haematoma, nerve injury, thrombosis, infections)Overall successFirst attempt success **Situation**Any elective or emergency procedure

#### PubMed

"Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR "administration, intravenous"[MeSH Terms] OR access\*[Title/Abstract] OR canula\*[Title/Abstract] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract]

AND

"femoral vein"[MeSH Terms] OR femoral\*[Text Word]

AND

"ultrasonography"[MeSH Terms] OR "Ultrasonics"[Mesh Terms] OR (ultrasound\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR ultrason\*[Title/Abstract] OR echograph\*[Title/Abstract])

NOT (“animals"[MeSH Terms] not “humans"[MeSH Terms])

NOT (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]) not “adult” [MeSH Terms]

Filters: Publication date from 2005/01/01 to 2017/12/31

|  |  |
| --- | --- |
| Search (((((("Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR "administration, intravenous"[MeSH Terms] OR access\*[Title/Abstract] OR canula\*[Title/Abstract] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract]) AND ( "2005/01/01"[PDat] : "2017/12/31"[PDat] ))) AND (("femoral vein"[MeSH Terms] OR femoral\*[Text Word]) AND ( "2005/01/01"[PDat] : "2017/12/31"[PDat] ))) AND (("ultrasonography"[MeSH Terms] OR "Ultrasonics"[Mesh Terms] OR (ultrasound\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR ultrason\*[Title/Abstract] OR echograph\*[Title/Abstract])) AND ( "2005/01/01"[PDat] : "2017/12/31"[PDat] ))) NOT (((“animals"[MeSH Terms] not “humans"[MeSH Terms])) AND ( "2005/01/01"[PDat] : "2017/12/31"[PDat] ))) NOT (((“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]) not “adult” [MeSH Terms]) AND ( "2005/01/01"[PDat] : "2017/12/31"[PDat] )) Filters: Publication date from 2005/01/01 to 2017/12/31 | [940](https://www.ncbi.nlm.nih.gov/pubmed/?cmd=HistorySearch&querykey=15) |

#### Embase

1 exp central venous catheter/ or exp central venous catheterization/ or exp intravenous drug administration/ or ((access\* adj10 (vein\* or venous or intravenous or vessel\*)) or can?ula\* or catheter\* or CVC).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading] (755899)  
2 exp femoral vein/ or femoral\*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading] (158016)  
3 exp echography/ or exp ultrasound/ or (ultrasound\* or ultra sound\* or ultrason\* or echograph\*).ti,ab. (849569)  
4 1 and 2 and 3 (4183)  
5 exp animal/ not exp human/ (4379191)  
6 4 not 5 (3955)  
7 exp juvenile/ not exp adult/ (2017542)  
8 6 not 7 (3519)  
9 limit 8 to yr="2005 -Current" (2782)

#### Cochrane Library - Central

#1 MeSH descriptor: [Central Venous Catheters] explode all trees 67

#2 MeSH descriptor: [Catheterization, Central Venous] explode all trees 845

#3 MeSH descriptor: [Administration, Intravenous] explode all trees 17023

#4 (access\* or can?ula\* or catheter\* or CVC) 39371

#5 #1 or #2 or #3 or #4 55426

#6 MeSH descriptor: [Femoral Vein] explode all trees 227

#7 femoral\* 8217

#8 #6 or #7 8217

#9 #5 and #8 1583

#10 MeSH descriptor: [Ultrasonography] explode all trees 9129

#11 MeSH descriptor: [Ultrasonics] explode all trees 298

#12 (ultrasound\* or ultra sound\* or ultrason\* or echograph\*) 26266

#13 #10 or #11 or #12 28369

#14 #9 and #13 339

#15 (paediatric\* or pediatric\* or child\* or infant\*) not (adult\* or aged or elderly) 80644

#16 #14 not #15 320

#17 #14 not #15 Publication Year from 2005 to 2016 257  
  
131 are trials from Central, the rest are reviews from Cochrane Library.

#### Cinahl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S1 | (MH "Central Venous Catheters+") OR (MH "Catheterization, Central Venous+") OR (MH "Administration, Central Venous") |  |  | 4,467 |
| S2 | TX (access\* OR Can\*ula\* OR catheter\* OR CVC) |  |  | 169,419 |
| S3 | S1 OR S2 |  |  | 169,425 |
| S4 | (MH "Femoral Vein") |  |  | 304 |
| S5 | TX femoral\* |  |  | 10,898 |
| S6 | S4 OR S5 |  |  | 10,898 |
| S7 | (MH "Ultrasonography+") OR (MH "Ultrasonics+") |  |  | 36,269 |
| S8 | TX (Ultrasound\* OR ultra sound\* OR ultrason\* OR echograph\*) |  |  | 47,976 |
| S9 | S7 OR S8 |  |  | 58,132 |
| S10 | S3 AND S6 AND S9 |  |  | 208 |
| S11 | (MH "Animals+") not (MH "Human") |  |  | 30,950 |
| S12 | S10 not S11 |  |  | 202 |
| S13 | (MH "Child+") not (MH "Adult+") |  |  | 255,856 |
| S14 | S12 not S13 |  |  | 186 |
| S15 | S12 not S13 Published: 20050101-20161231 |  |  | 144 |

# PICO 3

**A3. Population/problem**Adult patients requiring a peripheral vein cannulation **Intervention**Ultrasound-guided cannulation of any peripheral vein **Comparators**Any other technique of peripheral vein cannulation **Outcomes**Overall successFirst time successHaematoma **Situation**Any elective or emergency procedure

#### PubMed

"Catheterization, Peripheral"[Mesh] OR "Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR access\*[Title/Abstract] OR cannula\*[Title/Abstract] OR canula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR PVC[Title/Abstract] OR CVC[Title/Abstract]

AND

Peripheral\*[Title/Abstract]

AND

"ultrasonography"[MeSH Terms] OR "Ultrasonics"[Mesh Terms] OR (ultrasound\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR ultrason\*[Title/Abstract] OR echograph\*[Title/Abstract])

NOT (“animals"[MeSH Terms] not “humans"[MeSH Terms])

NOT (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]) not “adult” [MeSH Terms]

Filters: Publication date from 2005/01/01 to 2017/12/31

|  |  |
| --- | --- |
| Search (((((("Catheterization, Peripheral"[Mesh] OR "Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR access\*[Title/Abstract] OR cannula\*[Title/Abstract] OR canula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR PVC[Title/Abstract] OR CVC[Title/Abstract]))) AND Peripheral\*[Title/Abstract]) AND ("ultrasonography"[MeSH Terms] OR "Ultrasonics"[Mesh Terms] OR (ultrasound\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR ultrason\*[Title/Abstract] OR echograph\*[Title/Abstract]))) NOT ((“animals"[MeSH Terms] not “humans"[MeSH Terms]))) NOT ((“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]) not “adult” [MeSH Terms]) Filters: Publication date from 2005/01/01 to 2017/12/31 | [798](https://www.ncbi.nlm.nih.gov/pubmed/?cmd=HistorySearch&querykey=7) |

#### Embase

1 exp peripheral venous catheter/ or exp central venous catheter/ or exp central venous catheterization/ or ((access\* adj10 (vein\* or venous or intravenous or vessel\*)) or can?ula\* or catheter\* or CVC or PVC).ti,ab. (314846)

2 peripheral vein/ or peripheral\*.ti,ab. (626647)

3 exp echography/ or exp ultrasound/ or (ultrasound\* or ultra sound\* or ultrason\* or echograph\*).ti,ab. (849569)

4 1 and 2 and 3 (2709)

5 exp animal/ not exp human/ (4379191)

6 4 not 5 (2624)

7 exp juvenile/ not exp adult/ (2017542)

8 6 not 7 (2360)

9 limit 8 to yr="2005 -Current" (1897)

#### Cochrane Library Central

#### #1 MeSH descriptor: [Central Venous Catheters] explode all trees 67

#### #2 MeSH descriptor: [Catheterization, Central Venous] explode all trees 845

#### #3 MeSH descriptor: [Catheterization, Peripheral] explode all trees 812

#### #4 access\* or can?ula\* or catheter\* or CVC or PVC 39550

#### #5 #1 or #2 or #3 or #4 39550

#### #6 peripheral\* 28954

#### #7 #5 and #6 3126

#### #8 MeSH descriptor: [Ultrasonography] explode all trees 9129

#### #9 MeSH descriptor: [Ultrasonics] explode all trees 298

#### #10 (ultrasound\* or ultra sound\* or ultrason\* or echograph\*) 26266

#### #11 #8 or #9 or #10 28369

#### #12 #7 and #11 546

#### #13 (paediatric\* or pediatric\* or child\* or infant\*) not (adult\* or aged or elderly) 80644

#### #14 #12 not #13 497

#### #15 #12 not #13 Publication Year from 2005 to 2016 448 Only 161 are trials, the rest are reviews in Cochrane Library.

#### Cinahl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S1 | (MH "Central Venous Catheters+") OR (MH "Catheterization, Central Venous+")OR (MH "Peripherally Inserted Central Catheters") OR (MH "Catheterization, Peripheral Central Venous") OR (MH "Catheterization, Peripheral+") |  |  | 5,945 |
| S2 | TX (access\* OR can\*ula\* OR catheter\* OR CVC OR PVC) |  |  | 169,791 |
| S3 | S1 OR S2 |  |  | 169,791 |
| S4 | TX peripheral\* |  |  | 30,096 |
| S5 | (MH "Ultrasonography+") OR (MH "Ultrasonics+") |  |  | 36,269 |
| S6 | TX (Ultrasound\* OR ultra sound\* OR ultrason\* OR echograph\*) |  |  | 47,976 |
| S7 | S5 OR S6 |  |  | 58,132 |
| S8 | S3 AND S4 AND S7 |  |  | 432 |
| S9 | (MH "Animals+") not (MH "Human") |  |  | 30,950 |
| S10 | (MH "Child+") not (MH "Adult+") |  |  | 255,856 |
| S11 | S8 NOT S9 |  |  | 430 |
| S12 | S11 NOT S10 |  |  | 379 |
| S13 | S11 NOT S10 Published: 20050101-20161231 |  |  | 308 |

# PICO 4

**A4. Population/problem**

Adult patients requiring a long term venous cannulation for dialysis

**Intervention**

Ultrasound-guided placement of long term central venous catheters

**Comparators**

Any other technique of long term central venous catheter placement

**Outcomes**

Major complications (mechanical, infectious)

Pneumothorax

Pinch-off

Catheter tip malposition

Cardiac tamponade

**Situation**

Any elective situation

Search date: 10. January 2017

#### PubMed

# "Catheterization, Peripheral"[Mesh Terms] OR "catheterization, central venous"[MeSH Terms] OR "Vascular Access Devices"[MeSH Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract] OR PICC[Title/Abstract] AND

Implantable[Title/Abstract] OR “long term"[Title/Abstract]

AND

"Renal Dialysis"[Mesh Terms] OR "Dialysis"[Mesh Terms] OR dialysis[Title/Abstract]

AND

"ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract]))

NOT (“animals"[MeSH Terms] not “humans"[MeSH Terms])

NOT (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]) not “adult” [MeSH Terms]

Filters: Publication date from 2005/01/01 to 2017/12/31

|  |  |
| --- | --- |
| Search (((((("Catheterization, Peripheral"[Mesh Terms] OR "catheterization, central venous"[MeSH Terms] OR "Vascular Access Devices"[MeSH Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract] OR PICC[Title/Abstract])) AND (Implantable[Title/Abstract] OR “long term"[Title/Abstract])) AND ("Renal Dialysis"[Mesh Terms] OR "Dialysis"[Mesh Terms] OR dialysis[Title/Abstract])) AND ("ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract])))) NOT ((“animals"[MeSH Terms] not “humans"[MeSH Terms]))) NOT ((“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]) not “adult” [MeSH Terms]) Filters: Publication date from 2005/01/01 to 2017/12/31 | [52](https://www.ncbi.nlm.nih.gov/pubmed/?cmd=HistorySearch&querykey=14) |

#### Embase

1 exp peripheral venous catheter/ or exp central venous catheter/ or exp central venous catheterization/ or vascular access device/ or (can?ula\* or catheter\* or CVC or PICC).ti,ab. (304726)

2 (implantable or long term).ti,ab. (880806)

3 exp ultrasound/ or (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)).ti,ab. (427990)

4 exp dialysis catheter/ or exp dialysis/ or dialysis.mp. (155194)

5 1 and 2 and 3 and 4 (84)

6 exp animal/ not exp human/ (4492055)

7 5 not 6 (83)

8 exp juvenile/ not exp adult/ (2066006)

9 7 not 8 (80)

10 limit 9 to yr="2005 -Current" (62)

[mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]

Cochrane Library Central  
  
#1 MeSH descriptor: [Catheterization, Central Venous] explode all trees 845

#2 MeSH descriptor: [Vascular Access Devices] explode all trees 162

#3 MeSH descriptor: [Catheterization, Peripheral] explode all trees 813

#4 can?ula\* or catheter\* or CVC or PICC 21410

#5 #1 or #2 or #3 or #4 21435

#6 implantable or "long term" 68152

#7 MeSH descriptor: [Ultrasonography] explode all trees 9142

#8 (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)) 23966

#9 #7 or #8 26092

#10 #5 and #6 and #9 441

#11 MeSH descriptor: [Dialysis] explode all trees 232

#12 MeSH descriptor: [Renal Dialysis] explode all trees 4869

#13 dialysis 11530

#14 #11 or #12 or #13 11750

#15 #10 and #14 43

#16 (paediatric\* or pediatric\* or child\* or infant\*) not (adult\* or aged or elderly) 80645

#17 #15 not #16 42

#18 #15 not #16 Publication Year from 2005 to 2017, in Trials 2

#### Cinahl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S1 | (MH "Central Venous Catheters+") OR (MH "Catheterization, Central Venous+") OR (MH "Peripherally Inserted Central Catheters") OR (MH "Catheterization, Peripheral Central Venous") OR (MH "Catheterization, Peripheral+") OR (MH "Vascular Access Devices, Implantable") |  |  | 6,150 |
| S2 | TX (can\*ula\* OR catheter\* OR CVC OR PICC) |  |  | 36,945 |
| S3 | S1 OR S2 |  |  | 37,030 |
| S4 | (TX (implantable or "long term") |  |  | 103,358 |
| S5 | (MH "Ultrasonography+") |  |  | 35,606 |
| S6 | TX (Ultrasound\* OR ultra sound\* OR ultrasonograph\* OR (echograph\* AND an\*esth\*)) |  |  | 46,709 |
| S7 | S5 OR S6 |  |  | 56,894 |
| S8 | (MH "Dialysis") OR (MH "Catheters, Dialysis") |  |  | 2,684 |
| S9 | dialysis |  |  | 12,851 |
| S10 | S8 OR S9 |  |  | 12,851 |
| S11 | S3 AND S4 AND S7 AND S10 |  |  | 6 |
| S12 | (MH "Child+") not (MH "Adult+") |  |  | 256,446 |
| S13 | S11 not S12 |  |  | 6 |
| S14 | S11 not S12 Published: 20050101-20171231 |  |  | 6 |

# PICO 5

**A5. Population/problem**

Adult patients requiring an arterial cannulation

**Intervention**

Ultrasound-guided placement of arterial catheters

**Comparators**

Any other technique of arterial cannulation

**Outcomes**

Overall success

First time success

Haematoma

Infections causing CLABSI

Other minor complications

**Situation**

Any elective situation   
  
Search date: 10. January 2017

#### PubMed

catheterizat\*  
AND  
("Radial Artery"[Mesh]) OR "Femoral Artery"[Mesh] OR ((radial OR femoral) AND (arterial OR artery OR arteries))  
AND

"ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract]))

NOT (“animals"[MeSH Terms] not “humans"[MeSH Terms])

NOT (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]) not “adult” [MeSH Terms]

Filters: Publication date from 2005/01/01 to 2017/12/31

|  |  |  |
| --- | --- | --- |
| |  |  | | --- | --- | | Search ((((catheterizat\*) AND (("Radial Artery"[Mesh]) OR "Femoral Artery"[Mesh] OR ((radial OR femoral) AND (arterial OR artery OR arteries)))) AND ("ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract])))) NOT ((“animals"[MeSH Terms] not “humans"[MeSH Terms]))) NOT ((“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]) not “adult” [MeSH Terms]) Filters: Publication date from 2005/01/01 to 2017/12/31 | [555](https://www.ncbi.nlm.nih.gov/pubmed/?cmd=HistorySearch&querykey=15) | |

#### Embase

1 catheterizat\*.mp. (147131)

2 exp radial artery/ or exp femoral artery/ or ((radial or femoral) adj10 (arterial or artery or arteries)).mp. (59896)

3 exp ultrasound/ or (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)).ti,ab. (427990)

4 1 and 2 and 3 (891)

5 exp animal/ not exp human/ (4492055)

6 4 not 5 (871)

7 exp juvenile/ not exp adult/ (2066006)

8 6 not 7 (799)

9 limit 8 to yr="2005 -Current" (599)

#### Cochrane Library Central

#1 catheterizat\* 8357

#2 MeSH descriptor: [Radial Artery] explode all trees 436

#3 MeSH descriptor: [Femoral Artery] explode all trees 899

#4 (radial or femoral) near/10 (arterial or artery or arteries) 2923

#5 #2 or #3 or #4 2923

#6 MeSH descriptor: [Ultrasonography] explode all trees 9142

#7 (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)) 23966

#8 #6 or #7 26092

#9 #1 and #5 and #8 131

#10 (paediatric\* or pediatric\* or child\* or infant\*) not (adult\* or aged or elderly) 80645

#11 #9 not #10 119

#12 #9 not #10 Publication Year from 2005 to 2017, in Trials 73

#### Cinahl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S1 | TX Catheterizat\* |  |  | 14,153 |
| S2 | (MH "Radial Artery") OR (MH "Femoral Artery") |  |  | 1,563 |
| S3 | (radial or femoral) N10 (arterial or artery or arteries) |  |  | 2,588 |
| S4 | S2 OR S3 |  |  | 2,588 |
| S5 | (MH "Ultrasonography+") |  |  | 35,606 |
| S6 | TX (Ultrasound\* OR ultra sound\* OR ultrasonograph\* OR (echograph\* AND an\*esth\*)) |  |  | 46,709 |
| S7 | S5 OR S6 |  |  | 56,894 |
| S8 | S1 AND S4 AND S7 |  |  | 82 |
| S9 | (MH "Animals+") not (MH "Human") |  |  | 31,050 |
| S10 | S8 not S9 |  |  | 79 |
| S11 | (MH "Child+") not (MH "Adult+") |  |  | 256,446 |
| S12 | S10 not s11 |  |  | 72 |
| S13 | S10 not s11 Published: 20050101-20171231 |  |  | 53 |

# PICO 6

**A1.Population/problem**Paediatric patients requiring a central venous access  **Intervention**Ultrasound-guided cannulation of internal jugular vein, axillary vein (also named subclavian vein) **Comparators**Any other technique of central venous cannulation **Outcomes**Major complications (pneumothorax, arterial puncture, nerve injury, haemothorax)Minor complication (haematoma)Overall successFirst attempt successTime to cannulation **Situation**Any elective or emergency procedure  
  
Search date: 11. January 2017

#### PubMed

"Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract]

AND

 ("subclavian vein"[MeSH Terms] OR "Axillary vein"[MeSH Terms] OR "jugular veins"[MeSH Terms]) OR "Brachiocephalic Veins"[Mesh terms] OR (jugular\*[Text Word] OR axillar\*[Text Word] OR subclavian\*[Text Word] OR Brachiocephalic\*[Text Word])

AND

"ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract]))

NOT (“animals"[MeSH Terms] not “humans"[MeSH Terms])

NOT (“adult” [MeSH Terms] not (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]))

Filters: Publication date from 2005/01/01 to 2017/12/31

|  |  |
| --- | --- |
| Search ((((("Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract])) AND (("subclavian vein"[MeSH Terms] OR "Axillary vein"[MeSH Terms] OR "jugular veins"[MeSH Terms]) OR "Brachiocephalic Veins"[Mesh terms] OR (jugular\*[Text Word] OR axillar\*[Text Word] OR subclavian\*[Text Word] OR Brachiocephalic\*[Text Word]))) AND ("ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract])))) NOT ((“animals"[MeSH Terms] not “humans"[MeSH Terms]))) NOT ((“adult” [MeSH Terms] not (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]))) Filters: Publication date from 2005/01/01 to 2017/12/31 | [639](https://www.ncbi.nlm.nih.gov/pubmed/?cmd=HistorySearch&querykey=16) |

Embase  
  
1 exp central venous catheter/ or exp central venous catheterization/ or (can?ula\* or catheter\* or CVC).mp. (405854)  
2 exp subclavian vein/ or exp axillary vein/ or exp jugular vein/ or exp brachiocephalic vein/ or (jugular\* or axillar\* or subclavian\* or brachiocephalic\*).mp. (106773)  
3 exp ultrasound/ or (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)).ti,ab. (427990)  
4 1 and 2 and 3 (2379)  
5 exp animal/ not exp human/ (4492055)  
6 4 not 5 (2296)  
7 exp adult/ not exp juvenile/ (5381800)  
8 6 not 7 (1470)  
9 limit 8 to yr="2005 -Current" (1225)

[mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]

#### Central

#### #1 MeSH descriptor: [Central Venous Catheters] explode all trees 67 #2 MeSH descriptor: [Catheterization, Central Venous] explode all trees 845 #3 (can?ula\* or catheter\* or CVC) 21369 #4 #1 or #2 or #3 21369 #5 MeSH descriptor: [Subclavian Vein] explode all trees 104 #6 MeSH descriptor: [Axillary Vein] explode all trees 24 #7 MeSH descriptor: [Jugular Veins] explode all trees 235 #8 MeSH descriptor: [Brachiocephalic Veins] explode all trees 15 #9 (jugular\* or axillar\* or subclavian\* or Brachiocephalic\*) 4006 #10 #5 or #6 or #7 or #8 or #9 4006 #11 #4 and #10 800 #12 MeSH descriptor: [Ultrasonography] explode all trees 9142 #13 (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)) 23966 #14 #12 or #13 26092 #15 #11 and #14 260 #16 (adult\* or aged or elderly) not (paediatric\* or pediatric\* or child\* or infant\* or adolescen\*) 430282 #17 #15 not #16 145 #18 #15 not #16 Publication Year from 2005 to 2017, in Trials 70

#### Cinahl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S1 | (MH "Central Venous Catheters+") OR (MH "Catheterization, Central Venous+") |  |  | 4,459 |
| S2 | TX (can\*ula\* OR catheter\* OR CVC) |  |  | 36,839 |
| S3 | S1 OR S2 |  |  | 36,839 |
| S4 | (MH "Subclavian Vein") OR (MH "Axillary Vein") OR (MH "Jugular Veins") OR (MH "Brachiocephalic Veins") |  |  | 971 |
| S5 | TX (jugular\* OR axillar\* OR subclavian\* OR Brachiocephalic\*) |  |  | 4,804 |
| S6 | S4 OR S5 |  |  | 4,804 |
| S7 | (MH "Ultrasonography+") |  |  | 35,606 |
| S8 | TX (Ultrasound\* OR ultra sound\* OR ultrasonograph\* OR (echograph\* AND an\*esth\*)) |  |  | 46,709 |
| S9 | S7 OR S8 |  |  | 56,894 |
| S10 | S3 AND S6 AND S9 |  |  | 217 |
| S11 | (MH "Animals+") not (MH "Human") |  |  | 31,050 |
| S12 | S10 not S11 |  |  | 215 |
| S13 | (MH "Adult+") not (MH "Child+") |  |  | 753,614 |
| S14 | s12 not s13 |  |  | 131 |
| S15 | s12 not s13 Published: 20050101-20171231 |  |  | 106 |

# PICO 7

**Population/problem**Adult patients requiring a femoral venous access for elective or emergency situations **Intervention**Ultrasound-guided cannulation of the femoral vein **Comparators**Any other technique of femoral vein cannulation **Outcomes**Major complications (haematoma, nerve injury, thrombosis, infections)Overall successFirst attempt success **Situation**Any elective or emergency procedure  
  
Search date: 11. January 2017

#### PubMed

"Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract]

AND

"femoral vein"[MeSH Terms] OR femoral\*[Text Word]

AND

"ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract]))

NOT (“animals"[MeSH Terms] not “humans"[MeSH Terms])

NOT (“adult” [MeSH Terms] not (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]))

Filters: Publication date from 2005/01/01 to 2017/12/31

|  |  |
| --- | --- |
| Search (((((("Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract]))) AND ("femoral vein"[MeSH Terms] OR femoral\*[Text Word])) AND (("ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract]))))) NOT ((“animals"[MeSH Terms] not “humans"[MeSH Terms]))) NOT ((“adult” [MeSH Terms] not (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]))) Filters: Publication date from 2005/01/01 to 2017/12/31 | [348](https://www.ncbi.nlm.nih.gov/pubmed/?cmd=HistorySearch&querykey=17) |

Embase  
  
1 exp central venous catheter/ or exp central venous catheterization/ or (can?ula\* or catheter\* or CVC).mp. (405854)  
2 exp femoral vein/ or femoral\*.mp. (160917)  
3 exp ultrasound/ or (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)).ti,ab.  
(427990)  
4 1 and 2 and 3 (2083)  
5 exp animal/ not exp human/ (4492055)  
6 4 not 5 (1959)  
7 exp adult/ not exp juvenile/ (5381800)  
8 6 not 7 (1203)  
9 limit 8 to yr="2005 -Current" (999)

[mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]

#### Central

#### #1 MeSH descriptor: [Central Venous Catheters] explode all trees 67 #2 MeSH descriptor: [Catheterization, Central Venous] explode all trees 845 #3 (can?ula\* or catheter\* or CVC) 21369 #4 #1 or #2 or #3 21369 #5 MeSH descriptor: [Femoral Vein] explode all trees 228 #6 femoral\* 8217 #7 #5 or #6 8217 #8 #4 and #7 1089 #9 MeSH descriptor: [Ultrasonography] explode all trees 9142 #10 (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)) 23966 #11 #9 or #10 26092 #12 #8 and #11 257 #13 (adult\* or aged or elderly) not (paediatric\* or pediatric\* or child\* or infant\* or adolescen\*) 430282 #14 #12 not #13 122 #15 #12 not #13 Publication Year from 2005 to 2017, in Trials 46

#### Cinahl

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| S1 | | | (MH "Central Venous Catheters+") OR (MH "Catheterization, Central Venous+") | | |  |  | 4,459 |
| S2 | | | TX (Can\*ula\* OR catheter\* OR CVC) | | |  |  | 36,839 |
| S3 | | | S1 OR S2 | | |  |  | 36,839 |
| S4 | | | (MH "Femoral Vein") | | |  |  | 304 |
| S5 | | | TX femoral\* | | |  |  | 10,951 |
| S6 | | | S4 OR S5 | | |  |  | 10,951 |
| S7 | | | (MH "Ultrasonography+") | | |  |  | 35,606 |
| S8 | | | TX (Ultrasound\* OR ultra sound\* OR ultrasonograph\* OR (echograph\* AND an\*esth\*)) | | |  |  | 46,709 |
| S9 | | | S7 OR S8 | | |  |  | 56,894 |
| S10 | | | S3 AND S6 AND S9 | | |  |  | 159 |
| S11 | | | (MH "Animals+") not (MH "Human") | | |  |  | 31,050 |
| S12 | | | S10 not S11 | | |  |  | 154 |
| S13 | | | (MH "Adult+") not (MH "Child+") | | |  |  | 753,614 |
| S14 | | | S12 not S13 | | |  |  | 72 |
| S15 | | | S12 not S13 Published: 20050101-20171231 | | |  |  | 53 |
|  |  |  | |  |  |

# PICO 8

**A3. Population/problem**Adult patients requiring a peripheral vein cannulation **Intervention**Ultrasound-guided cannulation of any peripheral vein **Comparators**Any other technique of peripheral vein cannulation **Outcomes**Overall successFirst time successHaematoma **Situation**Any elective or emergency procedure

Search date: 11. January 2017

#### PubMed

"Catheterization, Peripheral"[Mesh Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR PVC[Title/Abstract]

AND

peripheral\*

AND

"ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract]))

NOT (“animals"[MeSH Terms] not “humans"[MeSH Terms])

NOT (“adult” [MeSH Terms] not (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]))

Filters: Publication date from 2005/01/01 to 2017/12/31

|  |  |
| --- | --- |
| Search ((((((("Catheterization, Peripheral"[Mesh Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR PVC[Title/Abstract]))) AND peripheral\*) AND ("ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract])))) NOT ((“animals"[MeSH Terms] not “humans"[MeSH Terms]))) NOT ((“adult” [MeSH Terms] not (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms])))) Filters: Publication date from 2005/01/01 to 2017/12/31 | [598](https://www.ncbi.nlm.nih.gov/pubmed/?cmd=HistorySearch&querykey=20) |

#### Embase

1 exp peripheral venous catheter/ or (can?ula\* or catheter\* or PVC).ti,ab. (302355)  
2 peripheral vein/ or peripheral\*.ti,ab. (637035)  
3 exp ultrasound/ or (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)).ti,ab.  
(427990)  
4 1 and 2 and 3 (1659)  
5 exp animal/ not exp human/ (4492055)  
6 4 not 5 (1614)  
7 exp adult/ not exp juvenile/ (5381800)  
8 6 not 7 (1166)  
9 limit 8 to yr="2005 -Current" (1003)

#### Central

#### #1 MeSH descriptor: [Catheterization, Peripheral] explode all trees 813 #2 can?ula\* or catheter\* or PVC 21427 #3 #1 or #2 21427 #4 peripheral\* 28965 #5 #3 and #4 2102 #6 MeSH descriptor: [Ultrasonography] explode all trees 9142 #7 (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)) 23966 #8 #6 or #7 26092 #9 #5 and #8 363 #10 (adult\* or aged or elderly) not (paediatric\* or pediatric\* or child\* or infant\* or adolescen\*) 430282 #11 #9 not #10 213 #12 #9 not #10 Publication Year from 2005 to 2017, in Trials 77

#### Cinahl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S1 | (MH "Catheterization, Peripheral+") |  |  | 2,070 |
| S2 | TX (can\*ula\* OR catheter\* OR PVC) |  |  | 37,083 |
| S3 | S1 OR S2 |  |  | 37,083 |
| S4 | TX peripheral\* |  |  | 30,415 |
| S5 | (MH "Ultrasonography+") |  |  | 35,606 |
| S6 | TX (Ultrasound\* OR ultra sound\* OR ultrasonograph\* OR (echograph\* AND an\*esth\*)) |  |  | 46,709 |
| S7 | S5 OR S6 |  |  | 56,894 |
| S8 | S3 AND S4 AND S7 |  |  | 381 |
| S9 | (MH "Animals+") not (MH "Human") |  |  | 31,050 |
| S10 | (MH "Adult+") not (MH "Child+") |  |  | 753,614 |
| S11 | S8 NOT S9 |  |  | 380 |
| S12 | S11 NOT S10 |  |  | 263 |
| S13 | S11 NOT S10 Published: 20050101-20171231 |  |  | 218 |

# PICO 9

**A4. Population/problem**Adult patients requiring a long term venous cannulation for dialysis **Intervention**Ultrasound-guided placement of long term central venous catheters **Comparators**Any other technique of long term central venous catheter placement **Outcomes**Major complications (mechanical, infectious)PneumothoraxPinch-offCatheter tip malpositionCardiac tamponade **Situation**Any elective situation

Search date: 11. January 2017

#### PubMed

# "Catheterization, Peripheral"[Mesh Terms] OR "catheterization, central venous"[MeSH Terms] OR "Vascular Access Devices"[MeSH Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract] OR PICC[Title/Abstract] AND

Implantable[Title/Abstract] OR “long term"[Title/Abstract]

AND

"Renal Dialysis"[Mesh Terms] OR "Dialysis"[Mesh Terms] OR dialysis[Title/Abstract]

AND

"ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract]))

NOT (“animals"[MeSH Terms] not “humans"[MeSH Terms])

NOT (“adult” [MeSH Terms] not (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]))

Filters: Publication date from 2005/01/01 to 2017/12/31

|  |  |
| --- | --- |
| Search ((((((("Catheterization, Peripheral"[Mesh Terms] OR "catheterization, central venous"[MeSH Terms] OR "Vascular Access Devices"[MeSH Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract] OR PICC[Title/Abstract]))) AND (Implantable[Title/Abstract] OR “long term"[Title/Abstract])) AND ("Renal Dialysis"[Mesh Terms] OR "Dialysis"[Mesh Terms] OR dialysis[Title/Abstract])) AND ("ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract])))) NOT ((“animals"[MeSH Terms] not “humans"[MeSH Terms]))) NOT ((“adult” [MeSH Terms] not (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]))) Filters: Publication date from 2005/01/01 to 2017/12/31 | [25](https://www.ncbi.nlm.nih.gov/pubmed/?cmd=HistorySearch&querykey=21) |

#### Embase

1 exp peripheral venous catheter/ or exp central venous catheter/ or exp central venous catheterization/ or vascular access device/ or (can?ula\* or catheter\* or CVC or PICC).ti,ab. (304726)  
2 (implantable or long term).ti,ab. (880806)  
3 exp ultrasound/ or (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)).ti,ab.  
(427990)  
4 exp dialysis catheter/ or exp dialysis/ or dialysis.mp. (155194)  
5 1 and 2 and 3 and 4 (84)  
6 exp animal/ not exp human/ (4492055)  
7 5 not 6 (83)  
8 exp adult/ not exp juvenile/ (5381800)  
9 7 not 8 (55)  
10 limit 9 to yr="2005 -Current" (45)

[mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading]

Central  
  
#1 MeSH descriptor: [Catheterization, Central Venous] explode all trees 845  
#2 MeSH descriptor: [Vascular Access Devices] explode all trees 162  
#3 MeSH descriptor: [Catheterization, Peripheral] explode all trees 813  
#4 can?ula\* or catheter\* or CVC or PICC 21410  
#5 #1 or #2 or #3 or #4 21435  
#6 implantable or "long term" 68152  
#7 MeSH descriptor: [Ultrasonography] explode all trees 9142  
#8 (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)) 23966  
#9 #7 or #8 26092  
#10 #5 and #6 and #9 441  
#11 MeSH descriptor: [Dialysis] explode all trees 232  
#12 MeSH descriptor: [Renal Dialysis] explode all trees 4869  
#13 dialysis 11530  
#14 #11 or #12 or #13 11750  
#15 #10 and #14 43  
#16 (adult\* or aged or elderly) not (paediatric\* or pediatric\* or child\* or infant\* or adolescen\*) 430282  
#17 #15 not #16 28  
#18 #15 not #16 Publication Year from 2005 to 2017, in Trials 1

#### Cinahl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S1 | (MH "Central Venous Catheters+") OR (MH "Catheterization, Central Venous+") OR (MH "Peripherally Inserted Central Catheters") OR (MH "Catheterization, Peripheral Central Venous") OR (MH "Catheterization, Peripheral+") OR (MH "Vascular Access Devices, Implantable") |  |  | 6,150 |
| S2 | TX (can\*ula\* OR catheter\* OR CVC OR PICC) |  |  | 36,945 |
| S3 | S1 OR S2 |  |  | 37,030 |
| S4 | (TX (implantable or "long term") |  |  | 103,358 |
| S5 | (MH "Ultrasonography+") |  |  | 35,606 |
| S6 | TX (Ultrasound\* OR ultra sound\* OR ultrasonograph\* OR (echograph\* AND an\*esth\*)) |  |  | 46,709 |
| S7 | S5 OR S6 |  |  | 56,894 |
| S8 | (MH "Dialysis") OR (MH "Catheters, Dialysis") |  |  | 2,684 |
| S9 | dialysis |  |  | 12,851 |
| S10 | S8 OR S9 |  |  | 12,851 |
| S11 | S3 AND S4 AND S7 AND S10 |  |  | 6 |
| S12 | (MH "Adult+") not (MH "Child+") |  |  | 753,614 |
| S13 | S11 not S12 |  |  | 3 |
| S14 | S11 not S12 Published: 20050101-20171231 |  |  | 3 |

#### 

# PICO 10

**A5. Population/problem**Adult patients requiring an arterial cannulation **Intervention**Ultrasound-guided placement of arterial catheters **Comparators**Any other technique of arterial cannulation **Outcomes**Overall successFirst time successHaematomaInfections causing CLABSIOther minor complications **Situation**Any elective situation   
  
Search date: 11. January 2017

#### PubMed

catheterizat\*  
  
AND  
  
("Radial Artery"[Mesh]) OR "Femoral Artery"[Mesh] OR ((radial OR femoral) AND (arterial OR artery OR arteries))  
  
AND

"ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract]))

NOT (“animals"[MeSH Terms] not “humans"[MeSH Terms])

NOT (“adult” [MeSH Terms] not (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms]))

Filters: Publication date from 2005/01/01 to 2017/12/31

|  |  |  |
| --- | --- | --- |
| |  |  | | --- | --- | | Search (((((catheterizat\*) AND (("Radial Artery"[Mesh]) OR "Femoral Artery"[Mesh] OR ((radial OR femoral) AND (arterial OR artery OR arteries)))) AND ("ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract])))) NOT ((“animals"[MeSH Terms] not “humans"[MeSH Terms]))) NOT ((“adult” [MeSH Terms] not (“child”[MeSH Terms] OR “infant”[MeSH Terms] OR “adolescent”[MeSH Terms])))) Filters: Publication date from 2005/01/01 to 2017/12/31 | [235](https://www.ncbi.nlm.nih.gov/pubmed/?cmd=HistorySearch&querykey=22) | |

#### Embase

1 catheterizat\*.mp. (147131)  
2 exp radial artery/ or exp femoral artery/ or ((radial or femoral) adj10 (arterial or artery or arteries)).mp.  
(59896)  
3 exp ultrasound/ or (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)).ti,ab. (427990)  
4 1 and 2 and 3 (891)  
5 exp animal/ not exp human/ (4492055)  
6 4 not 5 (871)  
7 exp adult/ not exp juvenile/ (5381800)  
8 6 not 7 (469)  
9 limit 8 to yr="2005 -Current" (389)

#### Central

#### #1 catheterizat\* 8357 #2 MeSH descriptor: [Radial Artery] explode all trees 436 #3 MeSH descriptor: [Femoral Artery] explode all trees 899 #4 (radial or femoral) near/10 (arterial or artery or arteries) 2923 #5 #2 or #3 or #4 2923 #6 MeSH descriptor: [Ultrasonography] explode all trees 9142 #7 (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)) 23966 #8 #6 or #7 26092 #9 #1 and #5 and #8 131 #10 (adult\* or aged or elderly) not (paediatric\* or pediatric\* or child\* or infant\* or adolescen\*) 430282 #11 #9 not #10 41 #12 #9 not #10 Publication Year from 2005 to 2017, in Trials 24

#### Cinahl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S1 | TX Catheterizat\* |  |  | 14,153 |
| S2 | (MH "Radial Artery") OR (MH "Femoral Artery") |  |  | 1,563 |
| S3 | (radial or femoral) N10 (arterial or artery or arteries) |  |  | 2,588 |
| S4 | S2 OR S3 |  |  | 2,588 |
| S5 | (MH "Ultrasonography+") |  |  | 35,606 |
| S6 | TX (Ultrasound\* OR ultra sound\* OR ultrasonograph\* OR (echograph\* AND an\*esth\*)) |  |  | 46,709 |
| S7 | S5 OR S6 |  |  | 56,894 |
| S8 | S1 AND S4 AND S7 |  |  | 82 |
| S9 | (MH "Animals+") not (MH "Human") |  |  | 31,050 |
| S10 | S8 not S9 |  |  | 79 |
| S11 | (MH "Adult+") not (MH "Child+") |  |  | 753,614 |
| S12 | S10 not s11 |  |  | 39 |
| S13 | S10 not s11 Published: 20050101-20171231 |  |  | 31 |

# PICO 11

**A6.**

**Population/problem**

Confirmation of the correct position of the central venous catheter in any patient receiving a central venous catheter

**Intervention**

Ultrasound evaluation of the catheter tip

**Comparators**

Any other technique of central venous catheter tip detection

**Outcomes**

Accuracy of the method

Cost-efficacy

**Situation**

Any elective or emergency situation

Search date: 6. March 2017

#### PubMed

"Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract]

AND

(Locat\*[Title/Abstract] OR Position\*[Title/Abstract] OR Malposition\*[Title/Abstract] OR evaluat\*[Title/Abstract] OR assess\*[Title/Abstract] OR detecti\*[Title/Abstract])

AND

(tip[Title/Abstract] OR tips[Title/Abstract])

AND

"ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract]))

NOT (“animals"[MeSH Terms] not “humans"[MeSH Terms])

Filters: Publication date from 2005/01/01 to 2017/12/31

|  |  |
| --- | --- |
| Search ((((("Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract])) AND ((Locat\*[Title/Abstract] OR Position\*[Title/Abstract] OR Malposition\*[Title/Abstract] OR evaluat\*[Title/Abstract] OR assess\*[Title/Abstract] OR detecti\*[Title/Abstract]))) AND ((tip[Title/Abstract] OR tips[Title/Abstract]))) AND ("ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract])))) NOT ((“animals"[MeSH Terms] not “humans"[MeSH Terms])) Filters: Publication date from 2005/01/01 to 2017/12/31 | [372](https://www.ncbi.nlm.nih.gov/pubmed/?cmd=HistorySearch&querykey=8) |

#### Embase

1 exp central venous catheter/ or exp central venous catheterization/ or (can?ula\* or catheter\* or CVC).mp. (409971)

2 ((Locat\* or Position\* or Malposition\* or evaluat\* or assess\* or detecti\*) and (tip or tips)).ti,ab. (37394)

3 exp ultrasound/ or (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)).ti,ab. (433159)

4 1 and 2 and 3 (1107)

5 exp animal/ not exp human/ (4516428)

6 4 not 5 (1041)

7 limit 6 to yr="2005 -Current" (841)

#### Central

#### #1 MeSH descriptor: [Central Venous Catheters] explode all trees 78 #2 MeSH descriptor: [Catheterization, Central Venous] explode all trees 865 #3 (can\*ula\* or catheter\* or CVC) 22646 #4 #1 or #2 or #3 22646 #5 (Locat\* or Position\* or Malposition\* or evaluat\* or assess\* or detecti\*) and (tip or tips) 2948 #6 #4 and #5 747 #7 MeSH descriptor: [Ultrasonography] explode all trees 9528 #8 (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an\*esth\*)) 25341 #9 #7 or #8 27594 #10 #6 and #9 169 #11 #10 Publication Year from 2005 to 2017, in Trials 63

#### Cinahl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S1 | (MH "Central Venous Catheters+") OR (MH "Catheterization, Central Venous+") |  |  | 4,479 |
| S2 | TX (can\*ula\* OR catheter\* OR CVC) |  |  | 37,149 |
| S3 | S1 OR S2 |  |  | 37,149 |
| S4 | TX (Locat\* or Position\* or Malposition\* or evaluat\* or assess\* or detecti\*) |  |  | 902,350 |
| S5 | TX (tip or tips) |  |  | 15,521 |
| S6 | (MH "Ultrasonography+") |  |  | 35,830 |
| S7 | TX (Ultrasound\* OR ultra sound\* OR ultrasonograph\* OR (echograph\* AND an\*esth\*)) |  |  | 47,050 |
| S8 | S6 OR S7 |  |  | 57,337 |
| S9 | S3 AND S4 AND S5 AND S8 |  |  | 99 |
| S10 | (MH "Animals+") not (MH "Human") |  |  | 31,176 |
| S11 | S9 not S10 |  |  | 94 |
| S12 | S9 not S10 Published: 20050101-20171231 |  |  | 68 |

# 12

**A7. Population/problem**

Verification of immediate post-procedural life-threatening complications in patients receiving central venous catheters

**Intervention**

Ultrasound evaluation of post-procedural life-threatening complications

**Comparators**

Any other technique of verification of immediate post-procedural life-threatening complications

**Outcomes**

Accuracy of the method

**Situation**

Any elective of emergency situation

Search date: 6. March 2017

#### PubMed

"Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract]

AND

("Mortality"[Mesh] OR "Death"[Mesh] OR danger\*[Title/Abstract] OR threat\*[Title/Abstract] OR mortal\*[Title/Abstract] OR dead\*[Title/Abstract] OR death\*[Title/Abstract])

AND

(Complication\*[Title/Abstract] OR adverse event\* OR "complications"[Subheading] or "adverse effects" [Subheading])

AND

"ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract]))

NOT (“animals"[MeSH Terms] not “humans"[MeSH Terms])

Filters: Publication date from 2005/01/01 to 2017/12/31

|  |  |
| --- | --- |
| Search (((((("Central Venous Catheters"[MeSH Terms] OR "catheterization, central venous"[MeSH Terms] OR cannula\*[Title/Abstract] OR catheter\*[Title/Abstract] OR CVC[Title/Abstract]))) AND (("Mortality"[Mesh] OR "Death"[Mesh] OR danger\*[Title/Abstract] OR threat\*[Title/Abstract] OR mortal\*[Title/Abstract] OR dead\*[Title/Abstract] OR death\*[Title/Abstract]))) AND ((Complication\*[Title/Abstract] OR adverse event\* OR "complications"[Subheading] or "adverse effects" [Subheading]))) AND ("ultrasonography"[MeSH Terms] OR ultrasound\*[Title/Abstract] OR ultrasonograph\*[Title/Abstract] OR ultra sound\*[Title/Abstract] OR (echograph\*[Title/Abstract] AND (anaesth\*[Title/Abstract] OR anesth\*[Title/Abstract])))) NOT ((“animals"[MeSH Terms] not “humans"[MeSH Terms])) Filters: Publication date from 2005/01/01 to 2017/12/31 | [850](https://www.ncbi.nlm.nih.gov/pubmed/?cmd=HistorySearch&querykey=8) |

#### Embase

1 exp central venous catheter/ or exp central venous catheterization/ or (can?ula\* or catheter\* or CVC).mp. (409971)

2 exp mortality/ or exp death/ or exp hazard/ or (danger\* or threat\* or mortal\* or dead\* or death\*).mp. (2862559)

3 exp complication/ or complication\*.mp. or adverse event\*.mp. or adverse effect\*.mp. or complication.fs. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading] (3146119)

4 exp ultrasound/ or (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an?esth\*)).ti,ab. (433159)

5 1 and 2 and 3 and 4 (1755)

6 exp animal/ not exp human/ (4516428)

7 5 not 6 (1733)

8 limit 7 to yr="2005 -Current" (1350)

#### Central

#### #1 MeSH descriptor: [Central Venous Catheters] explode all trees 78 #2 MeSH descriptor: [Catheterization, Central Venous] explode all trees 865 #3 (can\*ula\* or catheter\* or CVC) 22646 #4 #1 or #2 or #3 22646 #5 MeSH descriptor: [Mortality] explode all trees 12981 #6 MeSH descriptor: [Death] explode all trees 1900 #7 (danger\* or threat\* or mortal\* or dead\* or death\*) 96368 #8 #5 or #6 or #7 98754 #9 complication\* or adverse effect\* or adverse event\* 303336 #10 MeSH descriptor: [Ultrasonography] explode all trees 9528 #11 (ultrasound\* or ultra sound\* or ultrasonograph\* or (echograph\* and an\*esth\*)) 25341 #12 #10 or #11 27594 #13 #4 and #8 and #9 and #12 534 #14 #13 Publication Year from 2005 to 2017, in Trials 118

#### Cinahl

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S1 | (MH "Central Venous Catheters+") OR (MH "Catheterization, Central Venous+") |  |  | 4,479 |
| S2 | TX (can\*ula\* OR catheter\* OR CVC) |  |  | 37,149 |
| S3 | S1 OR S2 |  |  | 37,149 |
| S4 | TX (danger\* or threat\* or mortal\* or dead\* or death\*) |  |  | 234,945 |
| S5 | (MH "Mortality+") OR (MH "Death+") |  |  | 62,214 |
| S6 | S4 OR S5 |  |  | 239,843 |
| S7 | (MH "Adverse Health Care Event+") |  |  | 33,572 |
| S8 | TX (complication\* or adverse effect\* or adverse event\*) |  |  | 473,566 |
| S9 | S7 OR S8 |  |  | 494,540 |
| S10 | (MH "Ultrasonography+") |  |  | 35,830 |
| S11 | TX (Ultrasound\* OR ultra sound\* OR ultrasonograph\* OR (echograph\* AND an\*esth\*)) |  |  | 47,050 |
| S12 | S10 OR S11 |  |  | 57,337 |
| S13 | S3 AND S6 AND S9 AND S12 |  |  | 232 |
| S14 | (MH "Animals+") not (MH "Human") |  |  | 31,176 |
| S15 | S13 not S14 |  |  | 229 |
| S16 | S13 not S14 Published: 20050101-20171231 |  |  | 184 |