

PICC or peripheral intravenous catheter?

B.S. Niël-Weise¹, P.J. van den Broek²

¹Dutch Infection Prevention Working Party, Leiden, The Netherlands

²Department of Infectious Diseases, Leiden University Medical Centre

The following question was answered by a systematic review of the literature:

Should peripherally inserted central catheters (PICC) versus peripheral intravenous catheters be used in in-hospital patients with intravenous therapy?

Study population: inpatients requiring intravenous therapy

Comparison: PICC versus peripheral catheter

Outcome: phlebitis, catheter discontinuation because of complications, patients' satisfaction, catheter-related bloodstream infection, deep venous thrombosis, superficial venous thrombosis, difficult insertion

Methods

Data sources

Publications were retrieved by a search of Medline and the Cochrane Library up to 17 November 2008. The search strategy in Cochrane was: peripherally inserted central catheters* OR PICC. To identify randomised controlled trials in Medline the following search strategy was used: ((randomized controlled trial [pt] OR controlled clinical trial [pt] OR randomized controlled trials [mh] OR random allocation [mh] OR double-blind method [mh] OR single-blind method [mh] OR clinical trial [pt] OR clinical trials [mh] OR "clinical trial" [tw] OR ((singl* [tw] OR doubl* [tw] OR trebl* [tw] OR tripl* [tw]) AND (mask* [tw] OR blind* [tw])) OR "latin square" [tw] OR placebos [mh] OR placebo* [tw] OR random* [tw] OR research design [mh:noexp] OR comparative study [mh] OR evaluation studies [mh] OR follow-up studies [mh] OR prospective studies [mh] OR cross-over studies [mh] OR control* [tw] OR prospectiv* [tw] OR volunteer* [tw]) NOT (animal [mh] NOT human [mh])) AND (peripherally inserted central catheter* OR PICC). Additionally, all reference lists of identified trials were examined.

Selection criteria

All randomised and quasi-randomised trials comparing PICCs versus peripheral intravenous catheters and phlebitis, catheter discontinuation because of complications, patients' satisfaction, catheter-related bloodstream infection, deep venous thrombosis,

superficial venous thrombosis or difficult insertion as the outcome measures were included.

Review methods

Data were extracted by two reviewers independently and compared. Disagreements were resolved by discussion. Data from the original publications were used to calculate the relative risk of dichotomous outcomes. Data for similar outcomes were combined in the analysis where appropriate, using a random-effects model. The quality of evidence per outcome was assessed by using the Grade system ¹.

Results

One hundred and fifty nine potentially relevant studies were initially identified by our search. By judgement of titles and abstracts, 2 studies appeared to fulfil the selection criteria. Out of the two studies, one paper was excluded after reading the whole article ² (Table 1). One parallel-group randomised controlled trial was included in the review ³.

Validity assessment: see Table 2

Study population, interventions and outcome definitions: see Table 3

Grade Evidence profil: see table 4

Summary estimates of associations between treatment and control group: see Figure 1 and 2

Table 1 Excluded studies

Study	Reasons for exclusion
Schwengel 2004	Unclear methodology: patients randomized to PICC who had failed PICC placement were analyzed in the peripheral intravenous catheter group rather than an intention-to-treat group; it was unclear whether this was the case for all outcomes. Outcomes were not defined.

Table 2 Quality assessment

	Concealment of allocation	Description of dropouts (%)	Analysis by intention-to-treat	Stopping trial early to benefit	Selective reporting of events
Periard 2008	Adequate*	Adequate (7%)	Yes	No	No

Blinding of outcome assessment not feasible

* Not absolutely sure about that. Authors did not supply additional information on request.

Table 3 Study populations, interventions and outcome definitions

	Setting	Treatment (T) and control group (C)	Usage	Mean patient catheter days ¹ (SD)	End of study protocol	Outcomes n / N
Periard 2008	Inpatients of the department of medicine requiring i.v. therapy ≥ five days	T: PICC C: PC	Antimicrobial agents; Volume / electrolytes replacement; unfractionated heparin; diuretics; others	T: 9.4 (6.6) C: 7.3 (5.3)	Not reported	<p>Upper extremity deep venous thrombosis Defined by the presence at the end of the study of non-compressible material in the subclavian, axillary or humeral veins, which was absent at baseline (compression ultrasonography) T: 6 / 31; C: 1 / 29</p> <p>Upper extremity superficial venous thrombosis Defined by the presence at the end of the study of non-compressible material in the basilica or cephalic veins, which was absent at baseline (compression ultrasonography) T: 9 / 31; C: 13 / 29</p> <p>Catheter-related bloodstream infection Definition not reported T: 0 / 31; C: 0 / 29</p> <p>Catheter-related soft tissue infection (cellulitis) Defined by the presence of erythema, induration and pus at the site of insertion, in the presence of clinical or biological signs of infection. T: 1 / 31; C: 0 / 29</p>

¹When patients had more than one catheter on a day, this was counted as one catheter day.

Notes: A) Experienced staff inserted the catheters; B) The following outcomes were in favor of PICC (standard deviation not reported): the number of catheters required to complete the intravenous treatment, the number of venipunctures needed to insert catheters, the number of new venipunctures needed to draw blood; C) Patients' satisfaction was significantly higher in the PICC group (evaluated by means of a questionnaire assessing the frequency of venipuncture during hospital stay, the pain consecutive to these venipunctures and puncture failures, and the discomfort as a result of the catheter position on the arm)

Figure 1 Summary estimates of association between PICC and peripheral catheters expressed as relative risk (RR) and 95% confidence interval (CI).

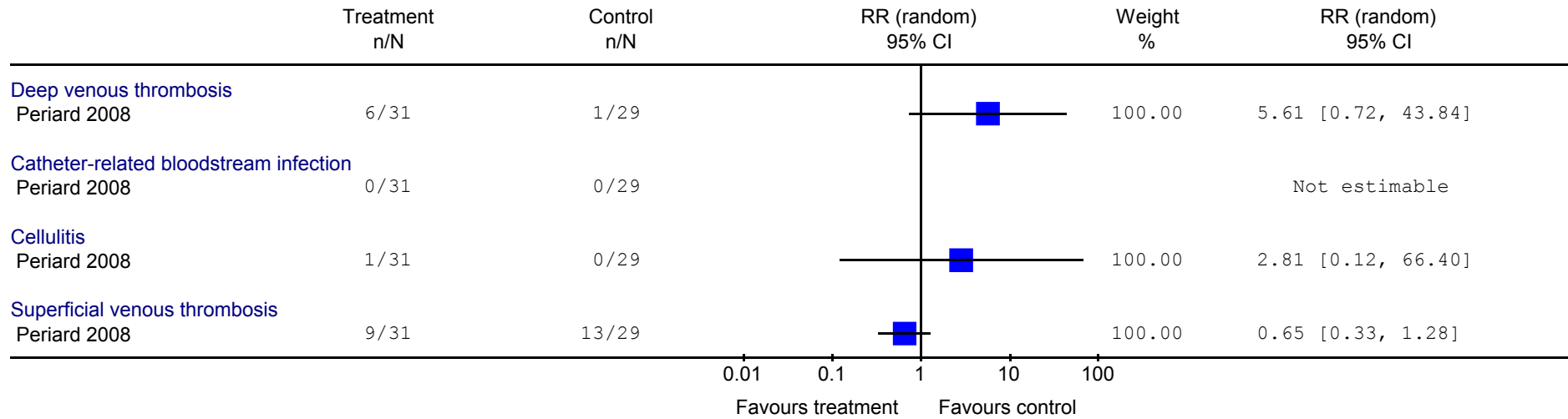


Figure 2 Summary estimates of association between PICC and peripheral catheters expressed as risk difference (RD) and 95% confidence interval (CI).

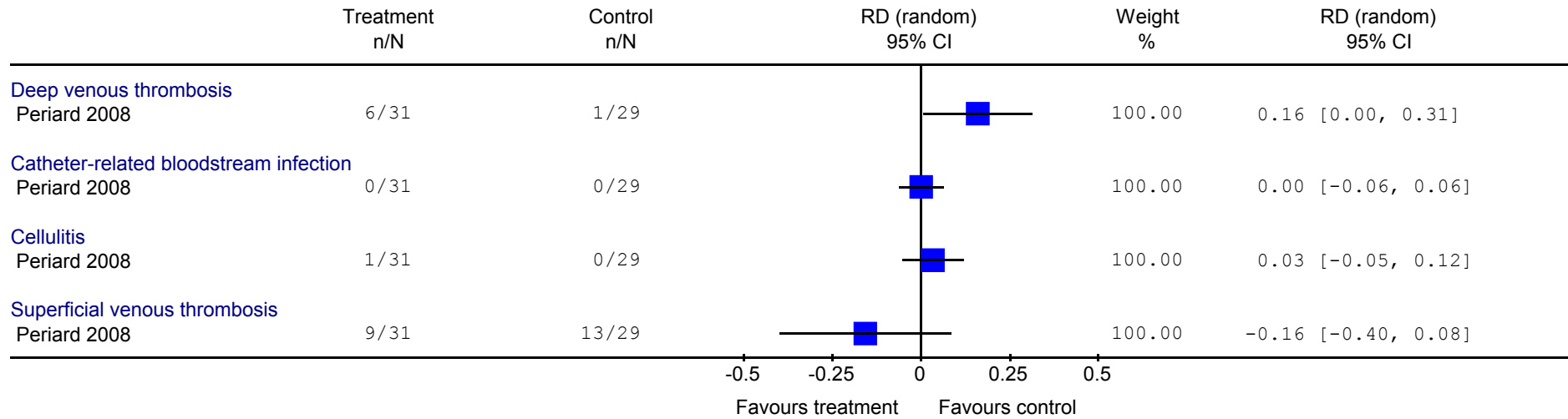


Table 4 Grade evidence profil

Quality assessment							Summary of findings					Importance
No of studies	Design	Limitations	Inconsistency	Indirectness	Imprecision	Other considerations	No of patients		Effect		Quality	
							peripherally inserted central catheters	peripheral catheters	Relative (95% CI)	Absolute		
Phlebitis - not reported												
0												CRITICAL
Catheter discontinuation because of complications - not reported												
0												CRITICAL
Patients' satisfaction - not reported												
0												IMPORTANT
Difficult insertion - not reported												
0												IMPORTANT
Upper extremity deep venous thrombosis (follow-up mean 8 days; compression ultrasonography in all (asymptomatic) patients)												
1	randomised trial	no serious limitations	serious ¹	no serious indirectness	serious ²	none	6/31 (19.4%)	1/29 (3.4%)	RR 5.61 (0.72 to 43.84)	157 more per 1000 (from 10 fewer to 1000 more)	++OO LOW	CRITICAL
Catheter-related bloodstream infection (follow-up mean 8 days)												
1	randomised trial	no serious limitations	serious ¹	no serious indirectness	serious ²	none	0/31 (0%)	0/29 (0%)	RR 0.94 (0.02 to 45.77) ³	0 fewer per 1000 (from 0 fewer to 0 more)	++OO LOW	CRITICAL
Cellulitis (follow-up mean 8 days; Erythema, induration and pus at the site of insertion; and clinical or biological sign of infection)												
1	randomised trial	no serious limitations	serious ¹	no serious indirectness	serious ²	none	1/31 (3.2%)	0/29 (0%)	RR 2.8 (0.12 to 66.40) ³	0 more per 1000	++OO LOW	IMPORTANT

Upper extremity superficial venous thrombosis (follow-up mean 8 days; compression ultrasonography in all patients)													
1	randomised trial	no serious limitations	serious ¹	no serious indirectness	serious ²	none		9/31 (29%)	13/29 (44.8%)	RR 0.65 (0.33 to 1.28)	157 fewer per 1000 (from 300 fewer to 125 more)	++OO LOW	IMPORTANT

¹ Single study

² Study with small sample size and wide confidence intervals

³ Calculated by Excel by adding 0.5 in the nominator and denominator

GRADE Working Group grades of evidence

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: We are very uncertain about the estimate.

Comments

Nowadays, PICCS are inserted in the upper arm. The authors did not report whether the PICCs were inserted in the forearm or the upper arm.

Conclusion

The evidence available whether PICCs are superior to peripheral intravenous catheters in patients requiring intravenous therapy to prevent phlebitis, catheter discontinuation because of complications, patients' satisfaction, catheter-related bloodstream infection, deep venous thrombosis, superficial venous thrombosis and difficult insertion, is not sufficient as a basis for determining practice. A single trial investigated this issue. The outcomes phlebitis and catheter discontinuation because of complications were not reported. For all other outcomes the quality of evidence was low. The results of deep venous thrombosis were in the disadvantage of PICCs, but with borderline statistical significance. For all other outcomes, the results were statistically not significant.

Reference List

1. Atkins D, Best D, Briss PA et al. Grading quality of evidence and strength of recommendations. *BMJ* 2004; 328: 1490.
2. Schwengel DA, McGready J, Berenholtz SM, Kozlowski LJ, Nichols DG, Yaster M. Peripherally inserted central catheters: a randomized, controlled, prospective trial in pediatric surgical patients. *Anesth Analg* 2004; 99: 1038-43, table.
3. Periard D, Monney P, Waeber G et al. Randomized controlled trial of peripherally inserted central catheters (PICC) versus peripheral catheters (PC) for middle duration in-hospital intravenous therapy. *J Thromb Haemost* 2008