Radial versus femoral approach for percutaneous coronary diagnostic and interventional procedures: systematic overview and meta-analysis of randomized trials

CRD summary
This meta-analysis compared transradial and transfemoral approaches for percutaneous coronary angiography or interventional procedures. It concluded that the transradial approach is a safe and effective alternative to the transfemoral approach, with fewer local vascular complications but a higher rate of procedural failure. The conclusions of this well-conducted review appear reliable.

Authors' objectives
To assess the safety and efficacy of transradial versus transfemoral access in patients undergoing percutaneous coronary angiography or interventional procedures.

Searching
MEDLINE and the Cochrane CENTRAL Register were searched from January 1989 to August 2003. A further search of bibliographies of retrieved articles, review articles and mRCT (metaRegister of Controlled Trials) was performed. The search was not restricted by the language of publication. Some keywords used were listed in the review. Conference proceedings from 2000 to 2003 for the following societies were checked by hand: American College of Cardiology, American Heart Association, European Society of Cardiology, and Transcatheter Cardiovascular Collaboration. Experts were also contacted to identify further trials.

Study selection
Study designs of evaluations included in the review
Randomised controlled trials (RCTs) with intention-to-treat analyses were eligible for inclusion. Exclusion criteria were less than 80% follow-up and a lack of clear and reproducible results (not further defined). The duration of follow-up ranged from 1 week to 9 months.

Specific interventions included in the review
Studies comparing transradial with transfemoral access were eligible for inclusion. In the included studies, a 6-F introducer was used for arterial access in the majority of patients, although some studies used 4-F, 5-F and 7-F introducers. All patients treated with transradial catheterisation were given intravenous heparin, whereas only patients treated with transfemoral catheterisation who were undergoing percutaneous coronary intervention (PCI) were administered heparin. Glycoprotein IIb/IIIa inhibitors and thrombolytic agents were used in a small number of patients in 2 studies.

Participants included in the review
Studies of patients undergoing PCI (angioplasty or stenting) or percutaneous coronary angiography were eligible for inclusion. The proportion of men in the included studies ranged from 53 to 100% (overall mean 70.8) and the mean age ranged from 58 to 83 years (overall mean 65 years).

Outcomes assessed in the review
No inclusion criteria for the outcomes were stated. The primary outcomes were major adverse cardiovascular events (MACE), entry site complications and procedural failure (defined as the need to puncture a second access site). MACE included death, myocardial infarction, emergency PCI or coronary artery bypass graft, and stroke. Definitions of each of these were given in the review. The secondary outcomes were procedural duration, fluoroscopy duration, length of hospital stay and the overall hospital costs.

How were decisions on the relevance of primary studies made?
One trained investigator conducted the literature searches. The authors did not provide further details of how the papers
Assessment of study quality
The validity of the included studies was evaluated by two investigators according to a 10-point scale. These criteria were the presence of: a statement of objectives; explicit inclusion and exclusion criteria; a description of the interventions; objective means of follow-up; a description of adverse events; power analysis; a description of statistical methods; multicentre design; a discussion of withdrawals; and details on medical therapy (e.g. antithrombotic regimens) during and after coronary procedures.

Two reviewers independently judged validity. Any discrepancies were resolved by consensus.

Data extraction
Two reviewers abstracted the data independently in an unblinded fashion on to predefined abstraction forms. The authors stated that there were no discrepancies between the two reviewers. The authors of the primary studies were contacted for additional data where necessary. Odds ratios (ORs), weighted mean differences (WMDs) and standardised mean differences (SMDs) were calculated.

Methods of synthesis
How were the studies combined?
Combined OR with 95% confidence intervals (CIs) were calculated using fixed-effect models (Mantel-Haenszel) and random-effects models (DerSimonian and Laird). The authors only published results from the random-effects models. WMDs and SMDs with 95% CIs were calculated using DerSimonian and Laird random-effects models.

How were differences between studies investigated?
Heterogeneity across the studies was assessed using the Q statistic. Subgroup analyses were based on surgical indication (<50% of participants undergoing diagnostic versus intervention surgery), study setting (elective versus acute), study quality (above versus below median score) and study reporting (abstract only versus not abstract only).

Results of the review
Twelve studies (3,224 patients) were included in the review.

The median validity score was 7. Three trials had a score of 1 and 3 trials had a score of 9.

MACE (12 trials, 3,224 patients): there was no difference in the risk of MACE when comparing radial and femoral access (OR 0.92, 95% CI: 0.57, 1.48, p=0.73). There was no evidence of statistically significant heterogeneity (p=0.73).

Entry site complications (12 trials, 3,224 patients): these were significantly less frequent in patients treated with radial access than with femoral access (OR 0.20, 95% CI: 0.09, 0.42, p<0.0001). There was no evidence of statistically significant heterogeneity (p=0.98).

Procedural failure (12 trials, 3,224 patients): this was significantly more common in patients treated with radial access than with femoral access (OR 3.30, 95% CI: 1.63, 6.71, p=0.0009). There was evidence of statistically significant heterogeneity (p=0.044).

Very similar results for each of these three outcomes were obtained for all subgroup analyses.

Procedural duration (11 trials, 3,082 patients): there was no significant difference in the procedural time reported between transfemoral and transradial groups (mean 33.8 minutes versus 35 minutes; WMD 1.62, 95% CI: -5.10, 8.34). The authors noted considerable clinical heterogeneity in the definitions of procedural duration between the primary studies.

Fluoroscopy duration (10 trials, 2,970 patients): this was significantly shorter in the transfemoral group (mean 7.8
minutes) than the transradial group (mean 8.9 minutes), (WMD 1.05, 95% CI: 0.51, 1.60, p<0.001).

Length of hospital stay (8 trials, 1,844 patients): this was significantly shorter in the transradial group (mean 1.8 days) than the transfemoral group (mean 2.4 days), (WMD -0.55, 95% CI: -0.82, -0.29, p<0.001).

**Cost information**
The overall hospital costs (5 trials, 853 patients) were lower in the transradial group than in the transfemoral group (SMD -1.43, 95% CI: -2.30, -0.55, p<0.001). No details of the actual costs or currencies were provided.

**Authors’ conclusions**
Transradial access provides similar clinical results and is as safe as transfemoral access for percutaneous coronary angiography or interventional procedures. There were fewer vascular entry site complications with the transradial approach, but a higher rate of procedural failure.

**CRD commentary**
The research question was clearly stated, as were inclusion criteria for the review. The search strategy appeared adequate and included trials databases, conference abstracts and contact with experts. No language restrictions were applied, but the search terms were not described in full. There were no details of how the studies were assessed for relevance, although efforts were made to reduce errors and bias through double data extraction. Validity was assessed using appropriate criteria for RCTs, and subgroup analyses were used to assess the effect of high- and low-quality studies on the primary outcomes. However, details of the individual validity components for each study were not reported, only a total score, making it difficult for review users to assess validity. The analysis methods used to pool the studies were appropriate, and where heterogeneity was detected the authors considered possible reasons. Pre-planned subgroup and sensitivity analyses were also conducted.

This was a well-conducted review and its conclusions are likely to be reliable.

**Implications of the review for practice and research**
Practice: The authors stated that the results of the review support the choice of transradial instead of transfemoral access for percutaneous coronary angiography or intervention, provided that the operators are experienced, suitably equipped, and willing to change to transfemoral access in instances of procedural failure.

Research: The authors did not state any implications for further research.

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