The role of arterial embolization in controlling pelvic fracture haemorrhage: a systematic review of the literature

Papakostidis C, Kanakaris N, Dimitriou R, Giannoudis PV

CRD summary
Pelvic angiography and transcatheter arterial embolisation seemed to represent effective acute interventions to control arterial bleeding in patients with serious pelvic trauma but its effectiveness comparative to other interventions was lacking. Potential for error and bias in the review and limited study quality mean that the evidence should be considered tentative and the authors' statement regarding comparative effectiveness should be heeded.

Authors' objectives
To evaluate the efficacy of emergency transcatheter arterial embolisation in controlling retroperitoneal arterial haemorrhage associated with unstable pelvic fractures.

Searching
MEDLINE was searched from 1979 to 2010 for articles published in English. Search terms were reported. Relevant reference lists from eligible articles and previous reviews were handsearched.

Study selection
Studies that included trauma patients with life-threatening haemorrhage due to pelvic ring disruption and who had undergone pelvic angiography were eligible for inclusion. Eligible studies had to include at least 10 consecutive patients and transcatheter arterial embolisation had to be one of the interventions for intrapelvic bleeding.

The principal outcomes of interest were efficacy rate of transcatheter arterial embolisation to control intrapelvic bleeding, mortality (due to persistent pelvic haemorrhage, concomitant trauma, complications and overall mortality) and frequency of associated angio-related complications. Other outcomes included rate of repeated procedures and blood transfusion requirements.

In the included studies, reported male to female ratios ranged from 0.9 to 5.2, mean average age ranged from 24.6 to 55 years and mean injury severity score (ISS) ranged from 19.4 to 46. Types of skeletal stabilisation were pelvic external fixation, acute internal fixation, pelvic binder, pneumatic anti-shock garments (PASG) and C clamp. Intervention timings (where reported) varied. Some patients had polytrauma. Studies were conducted between 1972 and 2007.

Two reviewers were involved in study selection. Any disagreements between the two reviewers were resolved by consensus.

Assessment of study quality
Study quality was evaluated using a self-made questionnaire that included questions on whether a protocol was clearly defined, whether descriptions of outcomes of interest were complete and whether details of relevant data that might have affected the outcome of interest were available. The maximum possible score for each study was 9 points (2 points for a positive answer to zero for a negative answer; randomised control trials received an additional 3 points, non-randomised comparative studies received an additional 2 points, prospective studies received an additional point and retrospective case series studies received no additional points).

Two reviewers were involved in the quality assessment.

Data extraction
One reviewer extracted the number of outcome events to calculate proportions and their 95% confidence intervals (effect sizes).

Methods of synthesis
If there was no apparent statistical heterogeneity. Effect sizes were combined to calculate weighted means and 95%
confidence intervals (CIs) for each outcome. Statistical heterogeneity was detected using Cochran's Q test and I². For the Cochran Q-test p<0.1 was considered to indicate statistical heterogeneity. For I², values of 25%, 50% and 75% represented low, moderate, and high degrees of statistical heterogeneity.

Sensitivity analysis was planned by excluding the studies with the lowest quality.

Results of the review
Twenty-one studies (16 retrospective and five prospective) were eligible for the review. The number of patients was unclear but where reported 879 patients (2.4% to 35%) underwent angiography and 734 patients (1.9% to 26%) underwent transcatheter arterial embolisation. Study quality scores ranged from 1 to 7 points (median 5) and represented low to moderate quality; none of the studies were rated with the top score of 9 points.

The efficacy rate of transcatheter arterial embolisation ranged from 81% to 100% (17 studies, 572 patients; I²=52%). Frequency of repeated transcatheter arterial embolisation procedures for effective control of haemorrhage ranged from zero to 19% (effect size 10%, 95% CI 7% to 13%; eight studies; I²=42%). Angiography was repeated in zero to 26% patients (seven studies, 456 patients; I²=73%).

Transcatheter arterial embolisation was associated with overall mortality that ranged from 7% to 47% (18 studies, 795 patients; I²=70%). Zero to 29% of mortality was due to concomitant trauma (13 studies, 490 patients; I²=50%). Zero to 25% of mortality was due to intrapelvic bleeding (effect size 6%, 95% CI 4% to 8%; 15 studies, 534 patients; I²=28%). Zero to 27% of mortality was due to lethal complications (effect size 8%, 95% CI 5% to 10%; 13 studies, 490 patients; I²=26%).

The rate of complications related to angio-transcatheter arterial embolisation was zero to 9.6% (effect size 1.1%, 95% CI 0.1% to 2.1%; 11 studies, 608 patients; I²=0%).

Sensitivity analysis showed that studies with extremely low ratings did not substantially influence the results.

Authors' conclusions
Pelvic angiography and transcatheter arterial embolisation seemed to represent effective acute interventions to control arterial bleeding in patients with serious pelvic trauma, but its comparative effectiveness to other interventions was lacking.

CRD commentary
The review addressed a clear question and was supported by appropriate inclusion criteria. The search was restricted to published studies in English language and publication and language biases could not be ruled out. Study quality was assessed. The overall quality of the studies was poor (most were case series and only one seemed to be a comparative study). Two reviewers selected the studies and assessed their quality assessment. Only one reviewer extracted data, so reviewer error and bias could not be ruled out. Some outcomes were not pooled and were instead presented as a proportion statistical heterogeneity. It was unclear whether the authors used a fixed-effect or random-effects model to combine outcome data.

The review had potential for error and bias. The included studies contained statistical heterogeneity and had limited quality. The evidence should be considered tentative and the authors' statement regarding comparative effectiveness should be heeded.

Implications of the review for practice and research
Practice: The authors suggested that pelvic angiography and transcatheter arterial embolisation should be prioritised in the list of emergent life saving approaches in cases of pelvic ring disruptions but its effectiveness compared to other approaches remained unclear.

Research: The authors suggested that robust evidence comparing pelvic tamponade with transcatheter arterial embolisation was needed.

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