

REVIEW

Ultrasound Guided Compression Versus Ultrasound Guided Thrombin Injection for the Treatment of Post-Catheterization Femoral Pseudoaneurysms: Systematic Review and Meta-Analysis of Comparative Studies

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WHAT THIS PAPER ADDS

As interventional procedures become increasingly common in the management of vascular disease, complications may be encountered more often. Post-catheterization pseudoaneurysms are a common cause of morbidity bearing a remarkable burden to the patient, physician, and health resources. As the mainstay of treatment has moved from surgical repair to less invasive, ultrasound-based techniques, it is important to summarize available evidence regarding efficacy and safety of treatment strategies. A systematic comparison of the main modalities, namely ultrasound guided compression and ultrasound guided thrombin injection has been performed to provide evidence regarding the optimal management of these lesions.

Objective: To compare results of ultrasound based techniques (ultrasound guided compression-(UGC) versus ultrasound guided thrombin injection (UGTI)) to treat iatrogenic post-catheterization femoral pseudoaneurysms.

Methods: The study design involved a systematic review of the literature and meta-analysis of comparative studies. The MEDLINE, CENTRAL, and OpenGray databases were searched up to October 2015. Primary outcome measure was efficacy, while other outcomes examined were safety (complication rate), duration of the procedure, length of hospitalization, and cost of methods. The random effects model was used to calculate combined overall effect sizes of pooled data. Data are presented as the odds ratio (OR) or mean difference (MD) with 95% confidence intervals (CI).

Results: Two randomized control trials and 11 observational studies were included in the analysis. Overall, 786 and 318 subjects underwent UGC and UGTI respectively. The latter modality resulted in a significantly higher success rate (97.4% vs. 69.3%, OR 0.06, 95% CI 0.03–0.11) while the complication rate for both techniques was very low (0.69% vs. 0.78%, OR 1.77, 95% CI 0.40–7.88). Data regarding procedural duration and length of hospitalization were very scarce, favoring UGTI (procedural time: MD 35.53 min, 9.11–63.95, length of hospitalization MD 1.99 days, –0.31–4.29). Scarcity of data did not allow proper cost analysis, but two studies suggested that UGTI may offer reduced treatment costs.

Conclusion: Available evidence suggests that UGTI is superior in terms of efficacy and as safe as UGC and thus should be used as the primary modality for the treatment of post-catheterization femoral pseudoaneurysms.

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INTRODUCTION

Percutaneous access through the femoral artery is very common during diagnostic and therapeutic procedures in both the coronary and peripheral circulation. At the same time that the radial approach is becoming increasingly

popular for cardiac interventions, endovascular techniques regarding peripheral vessels are almost universally performed through femoral access.^{1,2} Moreover, at present there is a tendency for minimally invasive therapies to be employed for the treatment of vascular diseases and therefore endovascular techniques have become the first line of treatment in many situations.^{3–5} Subsequently, the incidence of pseudoaneurysm formation after percutaneous procedures varies widely from 0.05% to 8.0%, but the increasing number of transluminal procedures may account for the frequency of post-interventional pseudoaneurysms.^{6,7}

Treatment of iatrogenic pseudoaneurysms aims to avoid possible complications; the most feared being rupture but also compression symptoms to the vein, nerve, or skin.^{8–10} The management of post-catheterization pseudoaneurysms has changed substantially over time moving from traditional surgical repair, which represented the only therapeutic modality before the 1990s, to the less invasive strategies of ultrasound guided compression (UGC) and ultrasound guided thrombin injection (UGTI). The former technique was introduced in 1991 and involves placement of the ultrasound probe directly over the neck of the pseudoaneurysm with application of downward pressure until flow is abolished in the sac.¹¹

Alternatively the UGTI technique described in 1997 by Liao et al. and tested in a larger patient cohort by Kang et al. in 1998, has gained increased popularity since its introduction.^{12,13} Although there is now a significant body of evidence regarding efficacy and safety of these two ultrasound based strategies, a systematic comparison between them, taking into account available data reported in comparative studies, has not been performed. The recent meta-analysis carried out by Tisi et al. considered only two randomized control trials (RCTs), ignoring a significant number of patients being reported in several observational non-randomized studies.¹⁴ These authors did not indicate superior efficacy of one method over the other, whereas safety and length of hospital stay were also similar. Nevertheless, it was suggested that compression (blind or ultrasound guided) should be used as the first line treatment, reserving thrombin injection for those in whom the compression procedure failed, despite this conclusion not being supported by the results of their analysis.

The aim of this systematic review and meta-analysis is to record the available data of comparison of the two treatment modalities UGC vs. UGTI, and provide evidence regarding efficacy and safety of one technique over the other.

MATERIALS AND METHODS

Selection criteria

The current analysis included studies that compared UGC with UGTI for treatment of iatrogenic femoral pseudoaneurysms. Each study had to include two groups of patients, one undergoing UGC and one UGTI, and report on the outcomes of the two treatment modalities. Change from one to the other technique, in case of failure, within each

study was allowed and was not used as an exclusion criterion. Both randomized and observational studies were included. Indications for initial endovascular procedures (i.e. cardiac vs. peripheral interventions) were not taken into account for the inclusion/exclusion into the analysis. Reports examining only the one or the other technique were excluded, as were case reports and review articles. Studies reporting other techniques being used for the management of femoral pseudoaneurysms like surgical reconstruction, manual compression, para-aneurysmal saline injection, etc., also were discarded.

Literature search

A literature search up to October 2015 was performed using the MEDLINE, CENTRAL, and OpenGray databases. To identify relevant studies, the following search terms were applied: (femoral pseudoaneurysm OR femoral false aneurysm) AND (Thrombin injection OR Ultrasound Compression). There were no language restrictions. Additionally, a manual search of the reference list of the selected articles and relevant reviews was performed to identify additional sources of data. A primary selection of relevant studies was based on the title and abstract, whereas a secondary selection was performed according to the full text of the publications by three authors (NK, DT, ET). Data were retrieved only from the manuscript, tables, or graphs, and no attempt was made to obtain missing data from the authors. Overall, the review protocol, the selection process and reporting was based on the 2009 Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement.¹⁵

Data extraction and assessment of data quality

Data were extracted from included studies by three authors (NK, AD, CI) using set criteria and recorded in tables in a standardized Excel file. Extracted data were reviewed independently by the other authors and any inconsistencies were recorded and resolved by discussion. A standard data extraction method was used to record the properties of each trial, including design, population characteristics, inclusion and exclusion criteria, and main outcome measures.

The quality of observational studies was assessed by use of the Newcastle—Ottawa scale, which is a 9 point scale that assigns points on the basis of the selection process (0–4 points), comparability (0–2 points), and identification of the exposure of study participants (0–3 points) in observational studies (http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp). In addition, the Cochrane risk of bias assessment tool was used to determine the methodological quality of the RCTs included in the analysis. Finally, rating of evidence quality of the meta-analysis was performed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) system. The GRADEpro module was used for this purpose (<http://tech.cochrane.org/revman/other-resources/grade>). The GRADE approach to rating the quality of evidence begins with the study design and then addresses five reasons to possibly rate down the

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