Pour AE, Keshavarze NR, et al. Is Venous Foot Pump Effective In Prevention of Thromboembolic Disease After Joint Arthroplasty: A Meta-Analysis. J Arthroplasty 2013;28:417-417.

Design: Meta-analysis of randomized clinical trials

Purpose of study: to compare the effectiveness of a venous foot pump with the effectiveness of chemoprophylaxis for the prevention of venous thrombotic events following total hip or total knee arthroplasty

PICOS:

- Patient population: adults undergoing total joint replacement of the hip or knee
- Intervention: a venous foot pump device after surgery
- Comparison: chemoprophylaxis with aspirin, heparin/aspirin, or low molecular weight heparin (LMWH)
- Outcomes: Deep vein thromboses (DVT) as diagnosed with venography or Doppler, major DVT, or pulmonary emboli
- Study types: randomized clinical trials only

Study selection:

- Databases were PubMed, EMBASE, Cochrane Register, and CINAHL through Feb 2011
- Two authors independently selected articles for inclusion and for quality using published guidelines
    - Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) Working Group methods were used to assess quality
    - Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) checklist was used to assess the adequacy of reporting of study data

Results:

- 42 papers were found, and 26 were published in the hip and knee literature
- 13 studies with 1514 patients were included in the final analysis
- For total hip replacement, 6 studies were included
    - In 1 study, the rate of DVT and major DVT was higher with the foot pump than with chemoprophylaxis, but the rate was lower or equal with the foot pump in the other 5 studies
    - Analysis revealed that the foot pump effectively decreases the rate of total DVT and major DVT compared to chemoprophylaxis
- For total knee replacement, 7 studies were included

    - In 3 studies, the rate of total DVT was higher with the foot pump, and the rate of major DVT was higher with the foot pump in 1 study
    - The rate of pulmonary emboli was higher in the chemoprophylaxis group in 2 studies and was higher in the foot pump group in 1 study
    - Analysis showed that chemoprophylaxis can lower the rate of DVT more compared to the foot pump, but the foot pump and chemoprophylaxis are not significantly different with respect to the rate of major DVT
- The hip and knee surgery data combined revealed that the foot pump revealed that the foot pump had a lower rate of DVT and major DVT

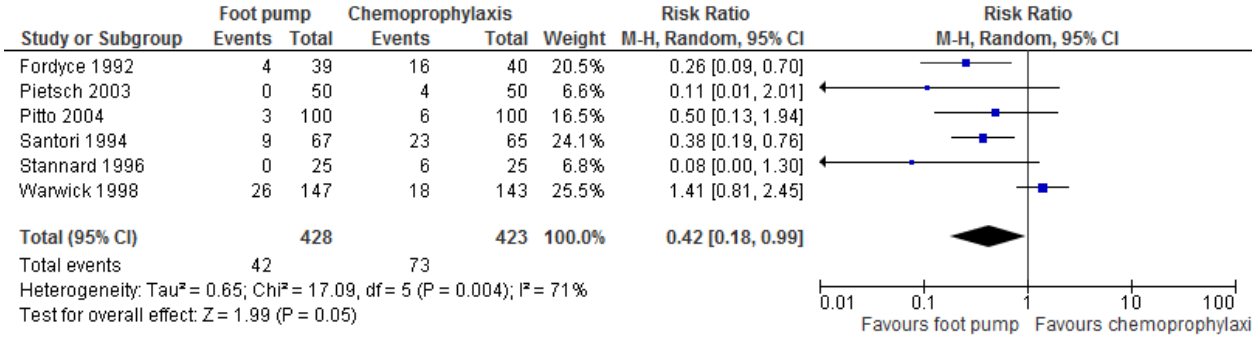
Authors' conclusions:

- The prevention of major thrombotic events after total joint replacement is controversial, but optimal use of a venous foot pump device alone or in combination with less potent chemoprophylaxis is an effective strategy in lowering the rate of thrombotic events while avoiding wound hematomas and other complications of more potent chemoprophylaxis
- Many of the foot pumps used in the included studies were older than some of the more current models of foot pump devices
- DVT diagnosed with Doppler or venography is not a strong predictor of pulmonary emboli

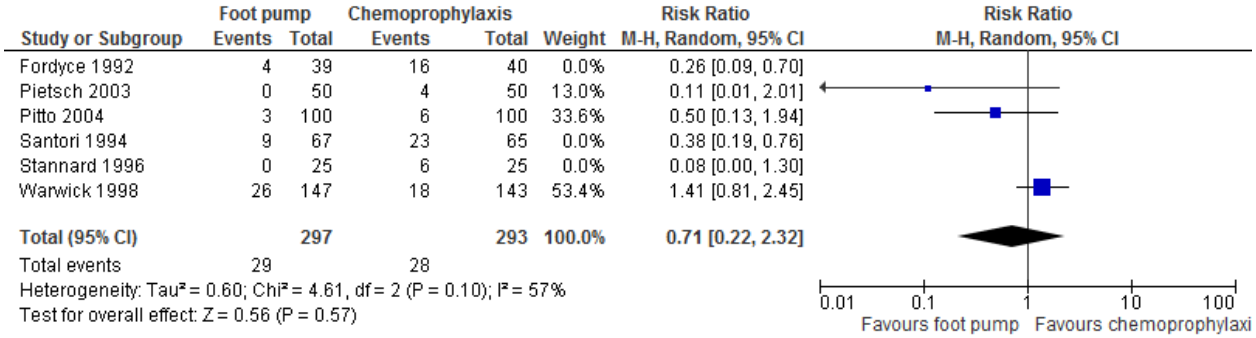
Comments:

- There are major problems with the meta-analysis, but it may be possible to salvage some interpretable results
- The rates of DVT in Table 2 are presented as percentages, not as numbers, making it necessary for the reader to calculate the actual numbers needed to reproduce the analyses
- The presentation of the summary data is unsatisfactory, since rate ratios are not clearly presented
    - For example in the section of total hip arthroplasty, the analysis what revealed that the foot pump could decrease the rate of DVT is presented as follows; "p=0.003, 95% confidence interval=0.38 to 0.78, I^2 =59%"
    - This may mean that there was a summary risk ratio between 0.38 and 0.78, probably around the middle of that interval, but the point estimate was lacking in all of the assertions that an analysis was performed to compare the foot pump with chemoprophylaxis
- There is no effort to explore the possible sources of heterogeneity, which was very high and deserves some examination
- The author's Figure 1, which takes up nearly an entire page, is the forest plot for total DVT in the hip patients; it may be more conveniently presented as follows after

computing the numbers of events for each study

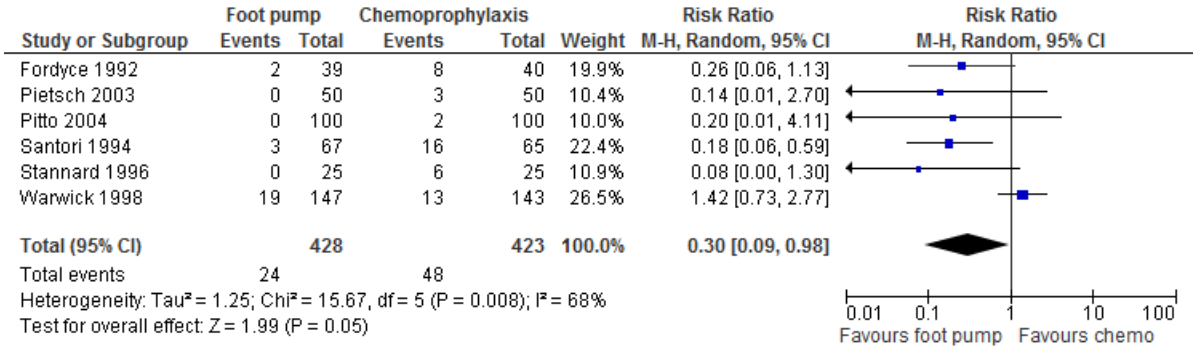


- This represents a relative risk of 0.42 favoring the foot pump over chemoprophylaxis, but there is great heterogeneity
- Three of the studies used heparin or heparin-ASA, while 3 studies used LMWH in the control arm; when these three LMWH studies are isolated, there is less of an advantage for the foot pump



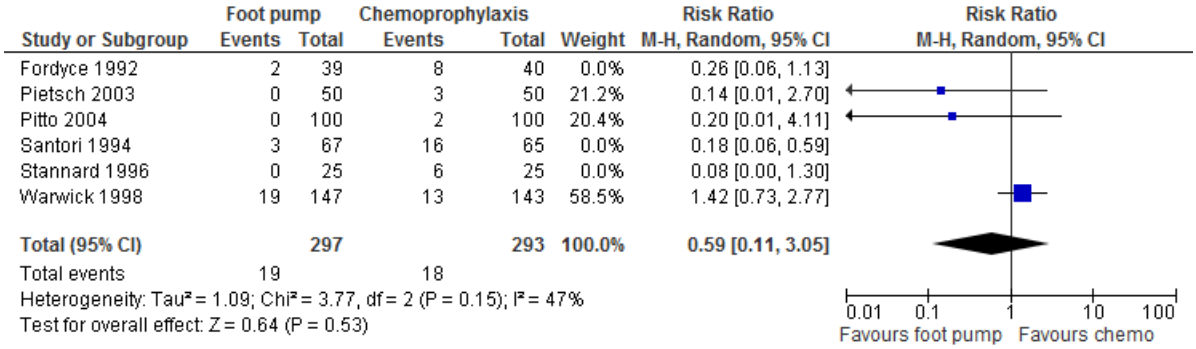
- The risk ratio still favors the foot pump, but the effect size is smaller and statistical significance is lost

- The authors' Figure 2, the forest plot for major DVT with the hip patients, can be reproduced as follows:

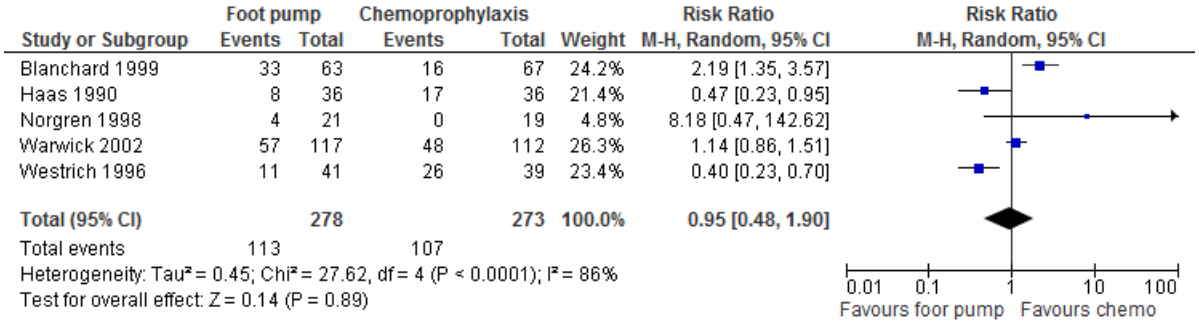


- The RR of 0.30 favors the foot pump but it is possible to again isolate the studies

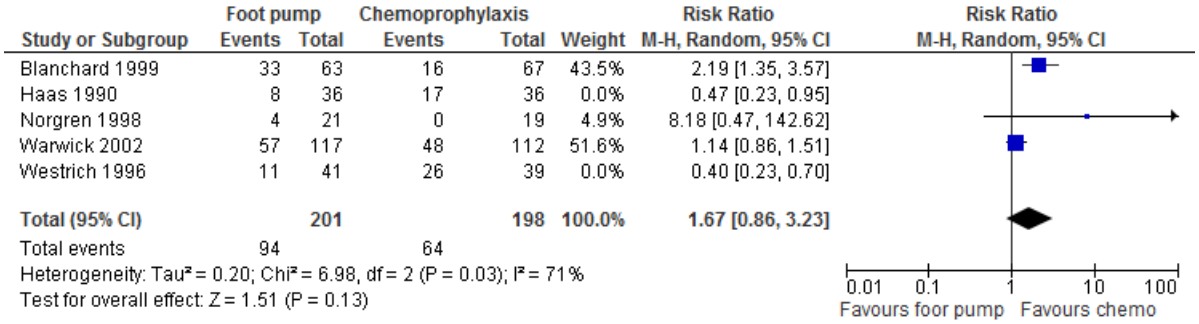
which used LMWH as the control treatment



- Again the RR is less favorable to the foot pump, and the degree of heterogeneity is reduced
- The authors' Figure 3 for total DVT in the knee patents, shows a RR very near 1; the two prevention strategies are equivalent with an RR of 0.95



- However, if the two trials which used ASA are removed, and the four trials of LMWH are pooled, the RR is 1.67 in favor of chemoprophylaxis, but is not statistically significant



- None of these considerations prove that LMWH is different from chemoprophylaxis with ASA, but the heterogeneity may arise from such differences in which interventions were used
- There appears to be an error in reporting of the rates of pulmonary emboli, which were rare and which were about evenly distributed between foot pump and chemoprophylaxis; in the Total Knee Arthroplasty section of the results, the author say that PE was more common in the Haas study, but the Table 2 shows no occurrence of PE for Haas, and the Haas abstract reports no data on PE

- In spite of the poor reporting and analysis, the conclusion that a state-of-the-art foot pump combined with a less potent form of chemoprophylaxis may be reasonable
- The decisions about which form of chemoprophylaxis to use may be one for the surgeons to make, depending on their perceptions of the benefits and risks of LMWH and other agents for wound healing
- PE is a rare complication of joint replacement, and there is no evidence that the prevention strategies differ with respect to its occurrence

Assessment: a poorly designed and poorly executed meta-analysis which nevertheless can be re-analyzed to provide good evidence that in the setting of total hip or knee replacement, a venous foot pump and a strategy using chemoprophylaxis with low-molecular weight heparin, heparin, or heparin combined with aspirin, confer approximately equal benefits for preventing thrombotic events, and that pulmonary emboli are a rare complication for which the two strategies are approximately equally beneficial