

# Paramedic - Evidence Based Medicine (P-EBP) Program

## Paramedic CAT (Critically Appraised Topic) Worksheet

**Title:** Does Primary care paramedic (PCP) can improve hemodynamically unstable patient with fluid loading.

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**Clinical Scenario:** 18:30. Ambulance called in the independent living area of a nursing home for a 74 y/o female who collapsed and fell on the floor in her bedroom. Her only complain during the last week was feeling sick whenever she stood up from the bed. Patient's past medical history not well known but she is regularly treated with calcium channel blockers, oral hypoglycemic drugs, ASA and Nitro spray. Except feeling weak and dizzy, she had a regular day. She took her meals and medication as prescribed. During the assessments, patient was pale, cold and wet. Increased breathing rhythm 28/min with a good air entry bilaterally, oxygen saturation 91%, Radial pulse weak, normal rhythm (66/min) and regular, Blood pressure 91/52, tympanic temperature 37.2<sup>c</sup>. Glasgow coma scale: 14 (confusion). The PCP crew gave her high flow oxygen by non-rebreather mask and decided to start a peripheral venous access. While doing that, they thought: "Patient's pulse should be faster and the blood pressure higher than it is actually. It is actually possible with basic skills to increase the patient's hemodynamic state by trying to activate the Bainbridge Reflex (Atrial reflex) with fluid bolus.

### **PICO (Population – Intervention – Comparison – Outcome) Question:**

Does a hemodynamically unstable patient will have a better fluid responsiveness to a Rapid intravenous (IV) Fluid Load (RFL) compare to a standard IV infusion?

### **Search Strategy:**

(Hypotension OR shock OR bradycardia OR "circularoty failure" OR "hemodynamically unstable")  
AND ("fluid therapy" OR "fluid resuscitation" OR "Fluid management" OR "infusion therapy" OR "IV Fluid" )  
AND (emerg\* OR ed OR ICU OR "intensive care unit" OR ambulance OR paramedic OR EMT OR EMS)



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AND (baroreflex OR "bainbridge reflex" OR "atrial reflex" OR baroreflex OR bolus OR "volume load" OR "rapid intravenous")

NOT (colloid OR children OR pediatric OR pregnant OR septic OR trauma OR sepsis OR infection)

Studies found by similar articles

## Search Outcome:

18

## Relevant Papers:

| AUTHOR, DATE  | POPULATION:<br>SAMPLE<br>CHARACTERISTICS            | DESIGN (LOE)   | OUTCOMES   | RESULTS  | STRENGTHS/<br>WEAKNESSES   |
|---------------|---|--|--|--|--|
| Bentzer, 2016 | Review of a total of 50 studies (N = 2260 patients) | Systematic review of studies in MEDLINE and EMBASE between 1966 and 2016.<br><br>LOE 1 | Relation between Fluid responsiveness (Improvement of cardiac output) and Passive leg raising (PLR) or Pulse pressure variation during the respiratory cycle | A low central venous pressure positive LR, 2.6 [95% CI, 1.4-4.6]; pooled specificity, 76%), High CVP (negative LR, 0.50 [95% CI,0.39-0.65]; pooled sensitivity, 62%).<br>Respiratory variation in vena cava diameter measured by ultrasound (positive LR, 5.3 [95% CI, 1.1-27]; pooled specificity, 85%).<br>Patients with less vena cava distensibility (negative LR, 0.27 [95% CI, 0.08-0.87]; pooled sensitivity, 77%). Augmentation of cardiac output following passive leg raising (positive LR, 11 [95% CI, 7.6-17]; pooled specificity, 92%).<br>lack of an increase in cardiac output with passive leg raising (negative LR, 0.13 [95% CI, 0.07-0.22]; pooled sensitivity, 88%). (p=0.001) | Pros:<br>Large review 50 studies<br>Large group of pts 2260<br>Can probably be generalized to EMS, Studies about pts in ED.<br><br>Cons:<br>No specification of IV fluid type.<br>No randomization |



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|------------------|--|--|--|--|---|
| Boulain, 2002    | 39 pts in ICU in circulatory failure receiving mechanical ventilation  | Prospective observational study with protocolized sequence<br>LOE 2        | Relation Between Blood pressure and PLR                    | PLR-induced changes in Radial artery pulse pressure (PPrad) were correlated to Rapid Fluid Load-induced changes in Stroke volume:<br>$r=0,74$ $p<0,001$  | Pros: Specific protocolized sequence<br><br>Cons: Small group Mechanically ventilated pts only. Study limited to ICU pts. |
| Cherpanath, 2016 | Meta –analysis review of 24 articles including 1013 pts $59 \pm 9$ y/o | Systematic review and meta-analysis based on PubMed articles.<br><br>LOE 1 | Correlation between Fluid Challenge responsiveness and PLR | High correlation between Cardiac Output and PLR:<br>sensitivity of 85% [95% CI, 78–90] and specificity of 92% [95% CI, 87–94] $p < 0.001$<br><br>When Blood pressure only assessed during PLR Low sensitivity of 58% [95% CI, 44–70] and specificity of 83% [95% CI, 68–92], $p < 0.001$ | Pros: large amount of data Large group<br><br>Cons: Half of pts were septic. Sometime Colloids fluid used                 |

## Comments:

- 45° angle of leg raising during 1 min while taking a blood pressure can be difficult to perform by paramedics in pt's residence.
- RFL can cause pulmonary edema and for that reason, every study chosen exclude CHF pts in the trial protocol.
- PLR test is more precise with Cardiac output measure than Blood pressure changes.

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**Consider:** Most studies on the subject conclude with the same result. RFL can increase the stroke volume and blood pressure on really ill patients for a short term. For the ambulance setting purpose it could be interesting to see if RFL can help to manage pt's circulatory condition during the transport time get advances cares. But those same studies show that PLR induced higher blood pressure only remains for few minutes and the same result applies to RFL. Also, it will be interesting to see the conclusion of the Australian REFRESH study by Stephen P. J. Macdonald about restricted fluid resuscitation during septic shock (actual reverse of current protocols).

**Clinical Bottom Line:** The Passive leg raising test is probably unfeasible at in the ambulance setting. The sensitivity on changes in blood pressure during the test is really lower than sensitivity on the cardiac output which it not observable in the ambulance. There are many undesirable risks with RFL (overload, Pulmonary Oedema, Increasing myocardial oxygen demand, Fluid shift in extravascular space...).

## **References:**

Bentzer P, Griesdale DE, Boyd J, MacLean K, Sirounis D, Ayas NT, Will This Hemodynamically Unstable Patient Respond to a Bolus of Intravenous Fluids? JAMA. 2016 Sep 27;316(12):1298-309. doi: 10.1001/jama.2016.12310.

Boulain T, Achard JM, Teboul JL, Richard C, Perrotin D, Ginies G., Changes in BP induced by passive leg raising predict response to fluid loading in critically ill patients. Chest. 2002 Apr;121(4):1245-52.

Macdonald SPJ, Taylor DM, Keijzers G, Arendts G, Fatovich DM, Kinnear FB, Brown SGA, Bellomo R, Burrows S, Fraser JF, et al. REstricted Fluid RESuscitation in Sepsis-associated Hypotension (REFRESH): study protocol for a pilot randomised controlled trial. Trials. 2017 Aug 29; 18(1):399. Epub 2017 Aug 29.

Cherpanath TG, Hirsch A, Geerts BF, Lagrand WK, Leeftang MM, Schultz MJ, Groeneveld AB. Predicting Fluid Responsiveness by Passive Leg Raising: A Systematic Review and Meta-Analysis of 23 Clinical Trials. Crit Care Med. 2016 May;44(5):981-91. doi: 10.1097/CCM.0000000000001556.

