Paracentesis-Induced Circulatory Dysfunction

Drew Brotherston¹, Alejandro Dau², Abbas Albaghli², Shane Arishenkoff²
¹ Division of General Internal Medicine, University of Calgary, ²Division of General Internal Medicine, University of British Columbia

Definitions and Significance
PICD is a broad term referring to circulatory dysfunction following Large-Volume Paracentesis (LVP, >5L drained), as a result of RAAS activation. It can persist up to six days post-paracentesis.
- Formally defined as an increase in PRA by >50% of the pretreatment value to a level of >4ng/mL per hour on the sixth day after paracentesis ⁸
- Occurs in up to 80% of LVP procedures in which plasma expanders are not used ¹ ⁻³ (see below)
- Associated with post-procedural hemodynamic instability, rapid reaccumulation of ascites, renal failure, hyponatremia, and increased mortality ⁸

Mechanism of Action
The pathophysiology of PICD is not well elucidated. Multiple mechanisms have been proposed:
1. Reduced intra-abdominal pressure post-paracentesis results in decreased right atrial/pulmonary pressures and systemic vasodilation. This leads to “over-compensatory” RAAS activation and ANP synthesis. ⁴
2. Rapid re-accumulation of ascites resulting in decreased total circulating volume. This has been theorized but not proven in the literature ⁴
3. “Shear stress” induced by increased cardiac output after paracentesis induces nitric oxide synthesis, resulting in systemic vasodilation ⁵

Predictors associated with PICD
1. Volume of fluid drained: No significant hormonal or hemodynamic changes observed when <5L are evacuated⁷. In the context of LVP, there is a direct correlation between the volume drained and the incidence of PICD. ¹ ⁻⁶, ¹³
2. Non-selective B-blockers (NSBB): Active use of NSBB has been reported to increase PICD, as well as baseline hypotension, renal failure, infection, and mortality in patients with refractory ascites ⁹⁻¹⁰. However, more recent studies have challenged this link ¹¹
3. Baseline demographics: Younger patients are at higher risk of PICD (hypothesized that older patients have blunted RAAS response and therefore protected from PICD).

*At baseline, the following populations are at increased risk of hepatorenal syndrome (and it can thus be hypothesized that their risk of PICD is thus higher also):
   a) Recent/active GI bleed
   b) Active infection (in particular, SBP)
   c) Metabolic abnormalities: Hyponatremia, baseline renal failure, acute hepatitis
References:


