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Goodbye Starling's Law, Hello G Tube

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Editorial

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Editorial

Substantial physics and physiological evidence with clinical relevance and significance currently exists that affirms Starling's law is wrong [1]. Starling [2] based his hypothesis on Poiseuille's work on strait uniform diameter tube [3] in which the hydrostatic pressure causes filtration, and the oncotic pressure force of plasma albumin causes re-absorption [4]. Recent evidence demonstrates Starling's law is wrong on both oncotic [5-10] and hydrostatic pressure [1,11,12] forces, and provides the correct replacement of hydrodynamic of the porous orifice G tube [1] (Figure 1).

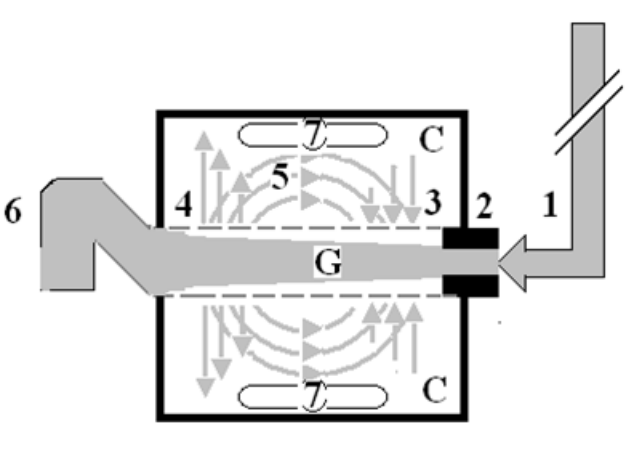

Figure 1 shows a diagrammatic representation of the hydrodynamic of G tube and surrounding chamber C. The G tube is a plastic porous tube and the chamber C around it is another bigger plastic tube to form the G-C apparatus- akin to capillary-interstitial fluid unit. The diagram numbers should read as follows:
1. The inflow pressure pushes fluid through the orifice
2. Creating fluid jet in the lumen of the G tube**.
3. The fluid jet creates negative side pressure gradient causing suction maximal over the proximal part of the G tube near the inlet that sucks fluid into lumen.
4. The side pressure gradient turns positive pushing fluid out of lumen maximum over the distal part near the outlet.
5. Thus, the fluid around G tube inside C moves in magnetic field-like circulation (5) taking an opposite direction to lumen flow of G. tube.
6. The inflow pressure 1 and orifice 2 induce the negative side pressure energy creating the dynamic G-C circulation phenomenon that is rapid, autonomous and efficient in moving fluid out from the G tube lumen at 4, irrigating C at 5, then sucking it back again at 3,
7. Maintaining net negative energy pressure inside chamber C.
**Note the shape of the fluid jet inside the G tube (Cone shaped), having a diameter of the inlet on right hand side and the diameter of the exit at left hand side (G tube diameter). I lost the photo on which the fluid jet was drawn, using tea leaves of fine and coarse sizes that runs in the center of G tube leaving the outer zone near the wall of G tube clear. Fine leaves exit G tube at pores near its outlet. This may explain the finding in real capillary of the protein-free (and erythrocyte-free) sub-endothelial zone in the Glycocalyx paradigm (Woodcock and Woodcock 2012).

The capillary has a pre-capillary sphincter and wide pores that allow the passage of molecules larger than plasma proteins [13]. This makes the capillary a porous orifice (G) tube with different hydrodynamic from Poiseuille's tube. The side pressure of G tube causes suction not filtration. The wide capillary pores nullify the oncotic force in vivo based on biochemical and clinical research using albumin and hyroxyethyl starch. The osmotic chemical composition of various body fluids is identical to plasma proteins. The interstitial fluid (ISF) space has a negative pressure of -7 cm water [14], so is lymph [15]. Clinical evidence on plasma albumin versus Saline shows no significant difference. This evidence affirms that the oncotic force does not exist in vivo that partly prove Starling's law wrong. Inadequacy in explaining the capillary–ISF transfer, has previously [16] and recently [17] called for reconsideration of Starling's hypothesis.

New physics and physiological research demonstrate that side pressure does not cause filtration across the wall of G tube, it causes suction. In G tube the negative side pressure gradient on its wall causing suction maximum near the inlet and turns positive maximum near the exit causing filtration. This creates a circulation between fluid in the lumen of G tube and surrounding fluid chamber (C) that runs in the opposite direction creating autonomous, dynamic rapid magnetic field like circulation (Figure 1). Physiological study completed the evidence that Starling's law is wrong as the capillary works as G tube not Poiseuille's tube. Oedema occurred with both albumin and saline when the fluid is run through the vein but not the artery. Both absorption and filtration are autonomous functions of G tube thus fit to replace Starling's law.

The clinical significance is that Starling's law dictates the faulty rules on fluid therapy causing many errors and misconceptions [18] that mislead physicians into giving too much fluid infusions of albumin and crystalloids for the resuscitation of shock which both cause edema of ISF space and vital organs as well as hypervolaemia with hypotension [19]. This shock is mistaken for septic or hemorrhagic shock and is wrongly treated with further huge volume expansion, occurring with both liberal and conservative approach of fluid therapy [20]. This induces volumetric overload shocks [21-24]. Volumetric overload inducing VOS is of 2 types; VOS 1 causes the transurethral resection of the prostate [TURP] syndrome [25], now being linked to the acute respiratory distress syndrome [ARDS] [26,27] that was reported by Ashbaugh, et al. [28] in 1967. ARDS is caused by VOS 2 with high morbidity and mortality and acute kidney injury (AKI) [29] as parts of the multiple organ dysfunction syndrome (MODS) [30]. Volumetric overload induced by persistence to elevate CVP to high level [31] as based on the faulty Starling's law. Work is now in progress that demonstrates VOS Cause ARDS, Constructing the BRIDGE between physics, physiology, biochemistry and clinical medicine [32,33].

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