



Uterine Hemostasis is Achieved by Thrombosis of Uterine Veins

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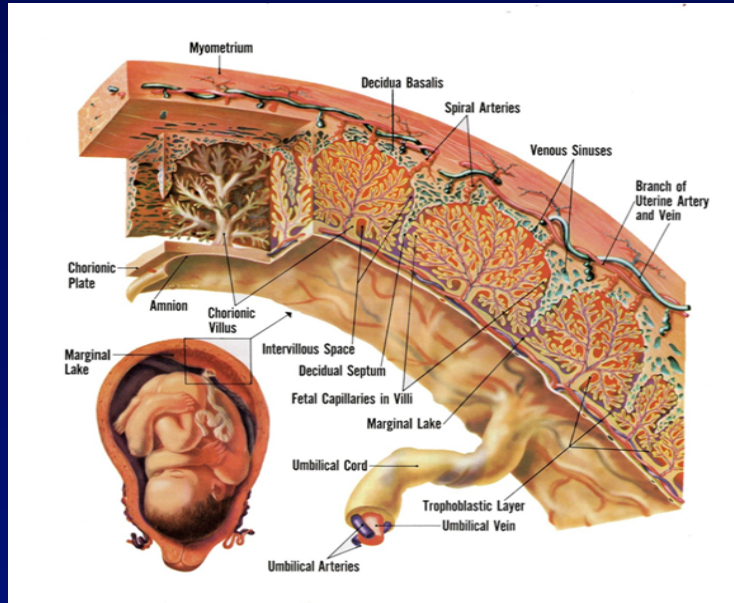
Evidence for Hemostasis by Thrombosis of Uterine Vessels

- Microscopic
- Macroscopic
- Biochemical



Obstetrical Bleeding

Bleeding that originates from the vessels within the gravid or postpartum uterus.





Term Placenta





Description of Microscopic Changes

“A physiologic obliteration takes place as the arteries undergo obliteration and hyaline degeneration, whereas the veins undergo thrombosis with subsequent organization.”

“The extreme efficiency with which the postpartum uterus solves its own problems of hemostasis...is noteworthy.”

1. Rutherford RN & Hertig AT. Noninvolution of the placental site. *Am J Obstet Gynecol*. 1945; 49:378-84



Involution and Subinvolution

- Involution is the process by which the uterus attempts to return to its prepregnancy size and condition.
- In normal involution, blood flow to the uterus declines from 15% of cardiac output to $< 1\%$ of cardiac output.
- In subinvolution bleeding is longer and heavier with a uterus that is softer than would be expected.



Surgical Pathology from 169 Cases of Delayed PPH – July, 1986 – June, 1991

Involuting placental bed tissue	Subinvoluting placental bed tissue
<ul style="list-style-type: none">• Hyalinized residua of uterine arteries• Arteries clearly demarcated from myometrium• Vascular lumina collapsed by thrombi• Occasional recanalization of the lumina of regenerating vessels	<ul style="list-style-type: none">• Widely distended, partly hyalinized vessels• Fresh thrombi on organizing thrombi• Thrombi only partly occluding the vessels

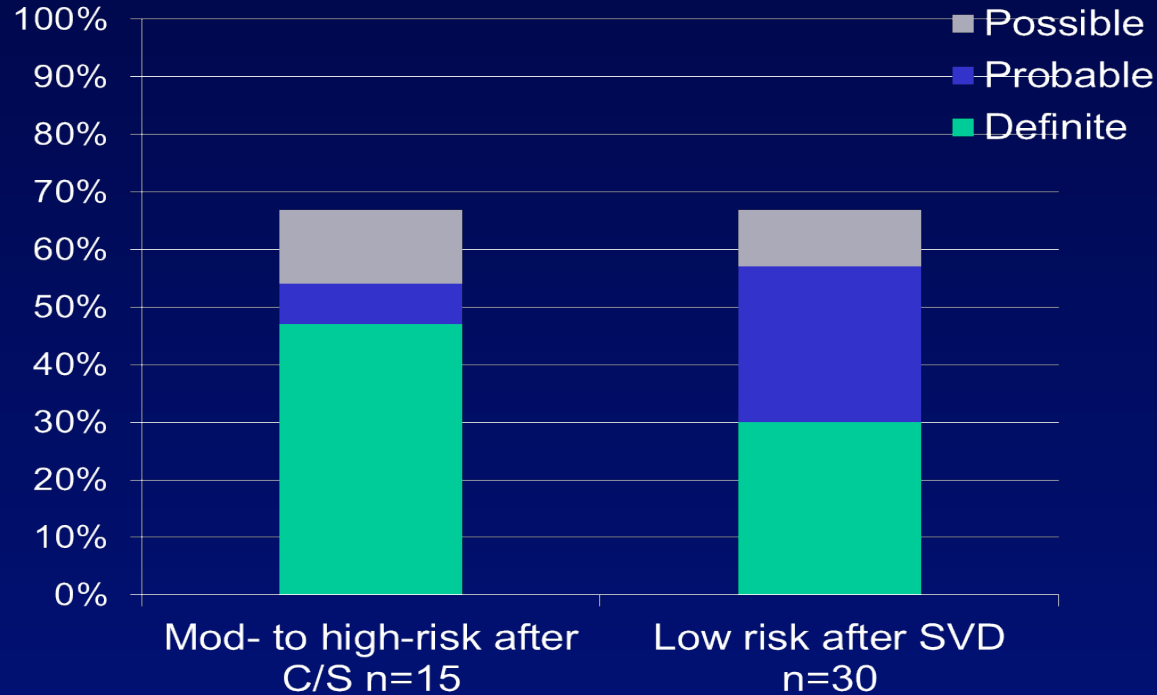


Macroscopic Changes – Pelvic Veins





Evidence of Pelvic Thrombosis on MRI PP



Khalil, et al. *Am J Obstet Gynecol.* 2012; Rodger, et al. *Am J Obstet Gynecol.* 2006

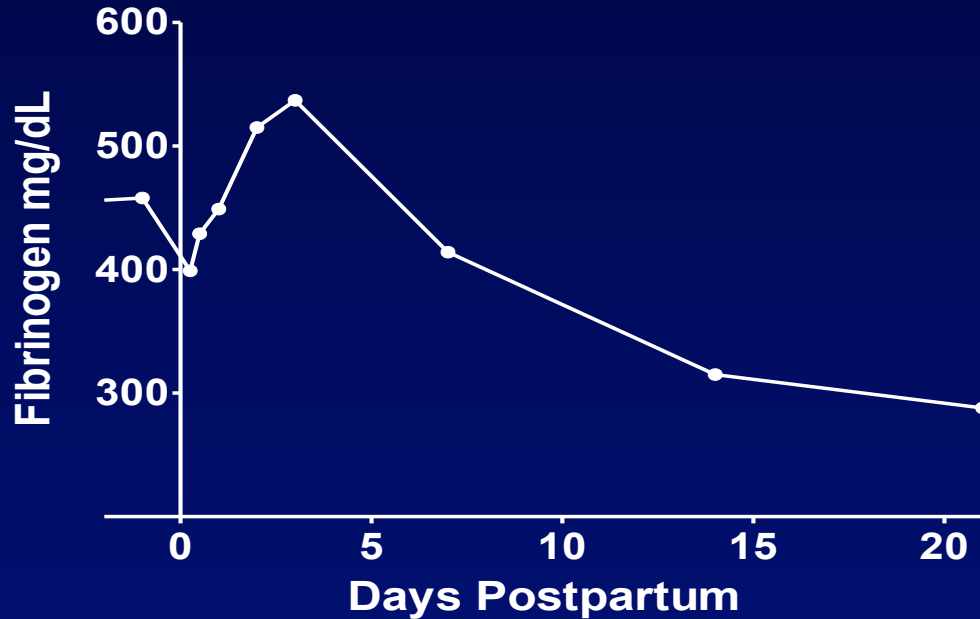


Thrombosis of Pelvic Veins

- Because venous bleeding from uterine veins can contribute to bleeding from the placental bed, perhaps we may infer that thrombosis of pelvic veins is part of the physiologic process that includes thrombosis of the uterine veins.
- Thrombosis of the uterine veins interrupts blood flow at the placental site, helps achieve uterine hemostasis and facilitates involution.

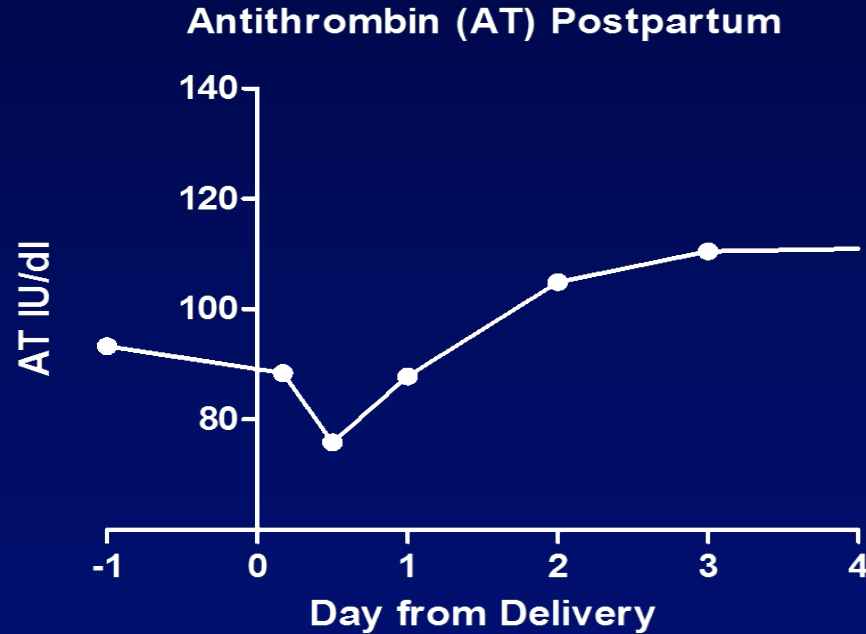


Biochemical Confirmation of the Process





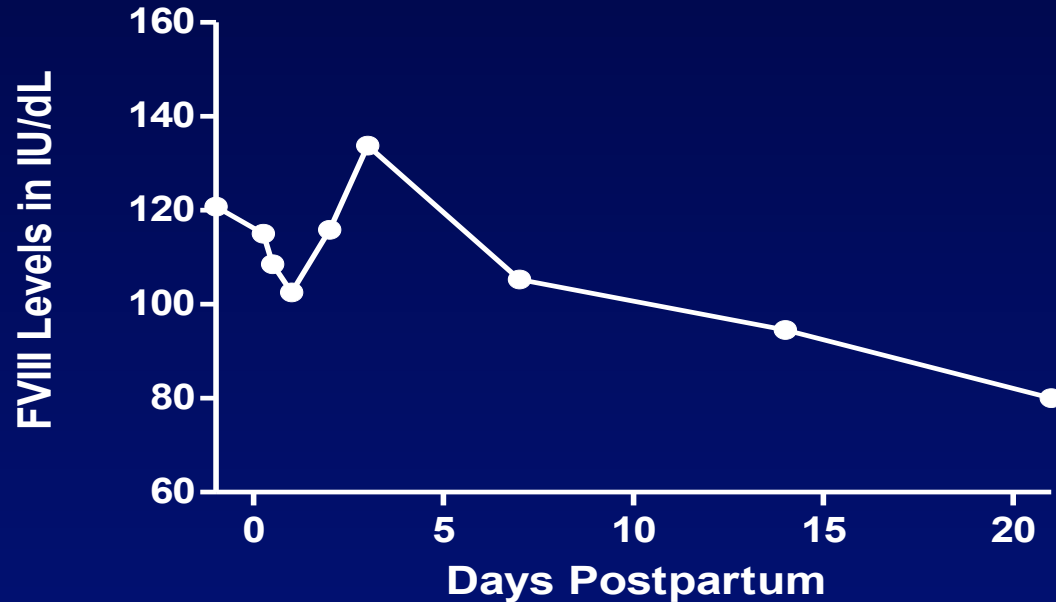
Biochemical Confirmation of the Process



James, et al. Characterization of Antithrombin Levels in Pregnancy. *Thrombosis Research*. 2014



Biochemical Confirmation of the Process



James, et al. Postpartum von Willebrand factor levels in women with and without von Willebrand disease and implications for prophylaxis. *Haemophili*, 2015



Uterine Vasculature

