**Answer Key** to **Nephrology Jumble Bumble: Collapsing Glomerulopathy (FSGS)**

1. **INTERFERON**
   Interferon alfa, beta, and gamma are all associated with collapsing glomerulopathy. Intereron alfa is used to treat hepatitis C, interferon beta multiple sclerosis, and interferon gamma chronic granulomatous disease and malignant osteopetrosis. The kidney injury is thought to be from direct toxicity on the podocytes. (See Swaminathan et al.)

2. **PARVOVIRUS**
   HIV is the most common virus known to cause collapsing glomerulopathy. There are increasing reports of association of Parovovirus B19 with collapsing glomerulopathy. The virus infects the podocytes and tubular epithelial cells leading to podocyte dedifferentiation. Other viruses associated with collapsing glomerulopathy are EBV, CMV, hepatitic C, and HTLV. (See Swaminathan et al.)

3. **ANTHRACYCLINE**
   Anthracycline antibiotics (doxorubicin and daunorubicin) have been associated with minimal change disease and FSGS, NOS. There are recent reports of collapsing glomerulopathy linked to anthracycline use. The suggested mechanism is direct podocyte damage from oxidative stress. (See Mohamed et al.)

4. **ISCHEMIA**
   De novo collapsing glomerulopathy has been reported during the post-transplant period, and has been associated with vascular lesions in the allograft. This suggests the possibility of ischemic podocyte trans-differentiation. The hypothesis is that hypoxia induces hypoxia-inducible-factor (HIF), increased VEGF, and ultimately glomerular collapse. The largest series of ischemia-associated collapsing glomerulopathy was presented at the ASN meeting in 2009 (TH-PO982).

5. **SIROLIMUS**
   There are reports of collapsing glomerulopathy in kidney transplant recipients with chronic allograft nephropathy after conversion from calcineurin inhibitors to sirolimus. The exact mechanism is unknown, but it is proposed that inhibition of the target of rapamycin (mTOR) results in reduced podocyte expression of critical proteins in the cytoskeleton, including nephron. This leads to FSGS. Withdrawal of the drug results in resolution of proteinuria. (See Letavernier et al.)

**Bonus answer:**
**HYPERFILTRATION**

A structural or functional reduction in kidney mass (renal agenesis, reflux nephropathy) or a hemodynamic stress on a normal nephron population (morbid obesity) leads to reflex vasodilatation of both the afferent and efferent arterioles. This causes elevation in the flow rate to the glomerular capillaries, glomerular hypertension, and elevation in the single-nephron glomerular filtration rate. The most common type of FSGS seen with this injury is usually not collapsing glomerulopathy. (See D'Agati et al.)