A 23 year old Caucasian male presented with shortness of breath, hypertension, bloody sputum, and a history of drug abuse (confirmed by urinalysis).

He was found to have severe kidney injury requiring dialysis, hematuria, proteinuria, anemia and thrombocytopenia.

A renal biopsy was performed.
Masson trichrome stain
Edematous intimal expansion
Schistocytes
“Myxoid”/ “mucoid” intimal expansion

H&E stain
Interlobular Artery Stained for Fibrin

Trichrome Stain

Anti-fibrin
H&E stain

Thick walls with GBM remodeling
Expanded Subendothelial Zone

Obliterative Capillary Remodeling
Swollen Endothelial Cells (Endotheliosis)
TTP-TMA, HUS-TMA and preeclampsia result from injury to endothelial cells.

Normal glomerular capillary with patent lumen.

TTP-TMA with platelet-rich thrombus.

HUS-TMA with subendothelial expansion.

Preeclampsia with endotheliosis.

Anti-VEGF therapy with hybrid lesion.
Thrombotic Microangiopathy (TMA)

- Thrombocytopenia, MAHA, fever, neurologic and renal abnormalities; low ADAMTS-13 (<10% actionable)

Thrombotic Thrombocytopenic Purpura (TTP)

Thrombocytopenia, MAHA and renal abnormalities;
> 10% ADAMTS-13

Hemolytic Uremic Syndrome (HUS)
Thrombotic Microangiopathy (TMA)

- Thrombocytopenia, MAHA, fever, neurologic and renal abnormalities; low ADAMTS-13 (<10% actionable)

Thrombotic Thrombocytopenic Purpura (TTP)

- Thrombocytopenia, MAHA and renal abnormalities; > 10% ADAMTS-13

Hemolytic Uremic Syndrome (HUS)

- No diarrhea (D- HUS)
  - Shiga-toxin producing infection, e.g. E coli

- Diarrhea (D+ HUS)

Atypical HUS

- Complement dysregulation
- Pregnancy associated
- Systemic sclerosis
- APL syndrome

Typical HUS

- Drug abuse
- Prescription drugs
- Radiation induced
- Malignant HTN
- Strep pneumonia

Many others
Pathologic Patterns of Thrombotic Microangiopathy

- TTP-TMA with platelet-rich thrombus
- HUS-TMA with subendothelial expansion
- Preeclampsia with endotheliosis
Thrombotic Thrombocytopenic Purpura (TTP)

Capillary Thrombi

Glomeruloid Structure

Endothelialized Thrombus
HUS LM

Thick walls

Fibrinoid Necrosis (H&E)  Schistocytes (H&E)
HUS Arterial Lesions

- Fibrinoid necrosis
- Intimal expansion obliterating lumen
- Schistocytes
In August 2012, a nephrologist reported to the Tennessee Department of Health (TDH) three cases of unexplained thrombotic thrombocytopenic purpura (TTP).

By the end of October, a total of 15 such cases had been reported. A case-control study determined that the cases were associated with dissolving and injecting tablets of Opana ER (Endo Pharmaceuticals).

Note: The cases were described as TTP-like, but the pathology clearly is HUS-type rather than TTP-type TMA.
Opana ER abuse and thrombotic thrombocytopenic purpura (TTP)-like illness: a rising risk factor in illicit drug users.
From Tennessee

Thrombotic microangiopathy and acute kidney injury associated with intravenous abuse of an oral extended-release formulation of oxymorphone hydrochloride: kidney biopsy findings and report of 3 cases.
Ambruzs JM, Serrell PB, Rahim N, Larsen CP.
Two from Tennessee, one from Idaho

Note: The cases were described as TTP-like, but the pathology clearly is HUS-type rather than TTP-type TMA.
Thrombotic microangiopathy and acute kidney injury associated with intravenous abuse of an oral extended-release formulation of oxymorphone hydrochloride: kidney biopsy findings and report of 3 cases.
Successful treatment of intravenously abused oral Opana ER-induced thrombotic microangiopathy without plasma exchange.

Resurgence of intravenous Opana as a cause of secondary thrombotic thrombocytopenic purpura.
Diagnosis:

Hemolytic Uremic Syndrome (HUS) type Thrombotic Microangiopathy (TMA), consistent with Opana-induced TMA