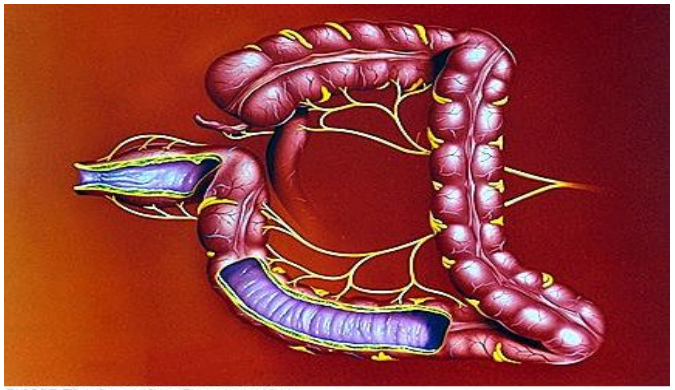
Necrotizing Enterocolitis

Bugs, Drugs and Things that go Bump in the Night



Morgan Stanley
Children's Hospital
of NewYork-Presbyterian
Columbia University Medical Center

“From ghoulies to ghosties and long leggety beasties & things that go bump in the night, good lord deliver us”

Old Cornish Prayer

- *"Caring for premature infant with NEC is like riding a mile-high roller coaster without brakes. All you can do is hang on for the ride and watch out for the bumps."*

RA Polin 2005

- √ *Epidemiology*
- √ *Pathophysiology*
- √ *Diagnosis*
- √ *Management*
- √ *Prevention*

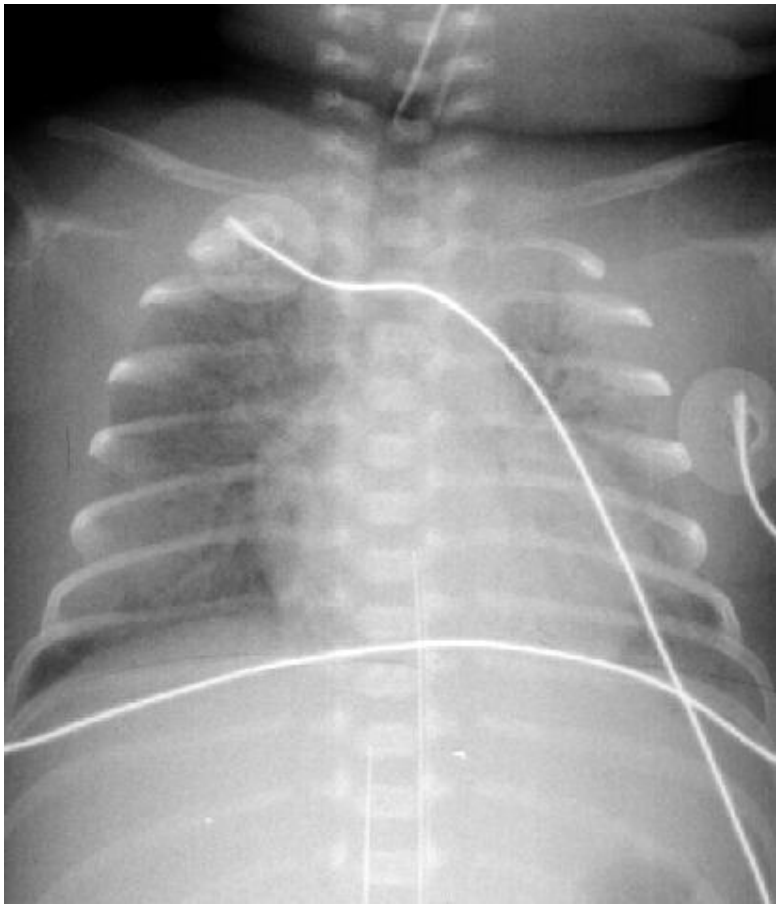
The Case Begins

- Baby “M” was a *1150 male infant* (27 wk gestation), born to a 26 year old woman. Mrs. “M” admitted to recreational use of *cocaine*. Three days prior to delivery she was given *indomethacin* because of preterm labor.

The case continued

√ The baby was delivered by emergency cesarean section because of late decelerations. *Apgar scores were 1 & 3* & baby “M” required endotracheal intubation.

The case continued



The case continued

√ Because of worsening respiratory distress, an *umbilical arterial line* was placed at L4. A CBC obtained from the UA was remarkable for a *Hct = 71%.* On day one of life, the infant was placed on TPN.

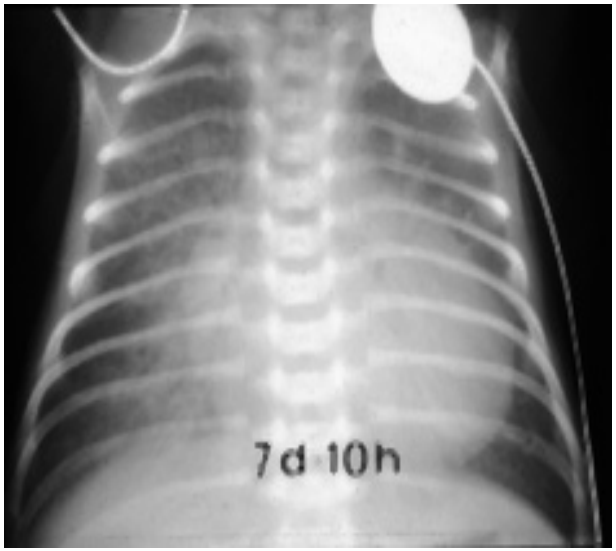
The case continued

√ Within 72 hours, *feedings* were begun. The baby was *advanced to full feedings over 3 days*. On day 4 of life, a murmur was heard and an echocardiogram and chest x-ray were obtained. Total fluid intake at that time was *185 ml/kg day*.

The case continued

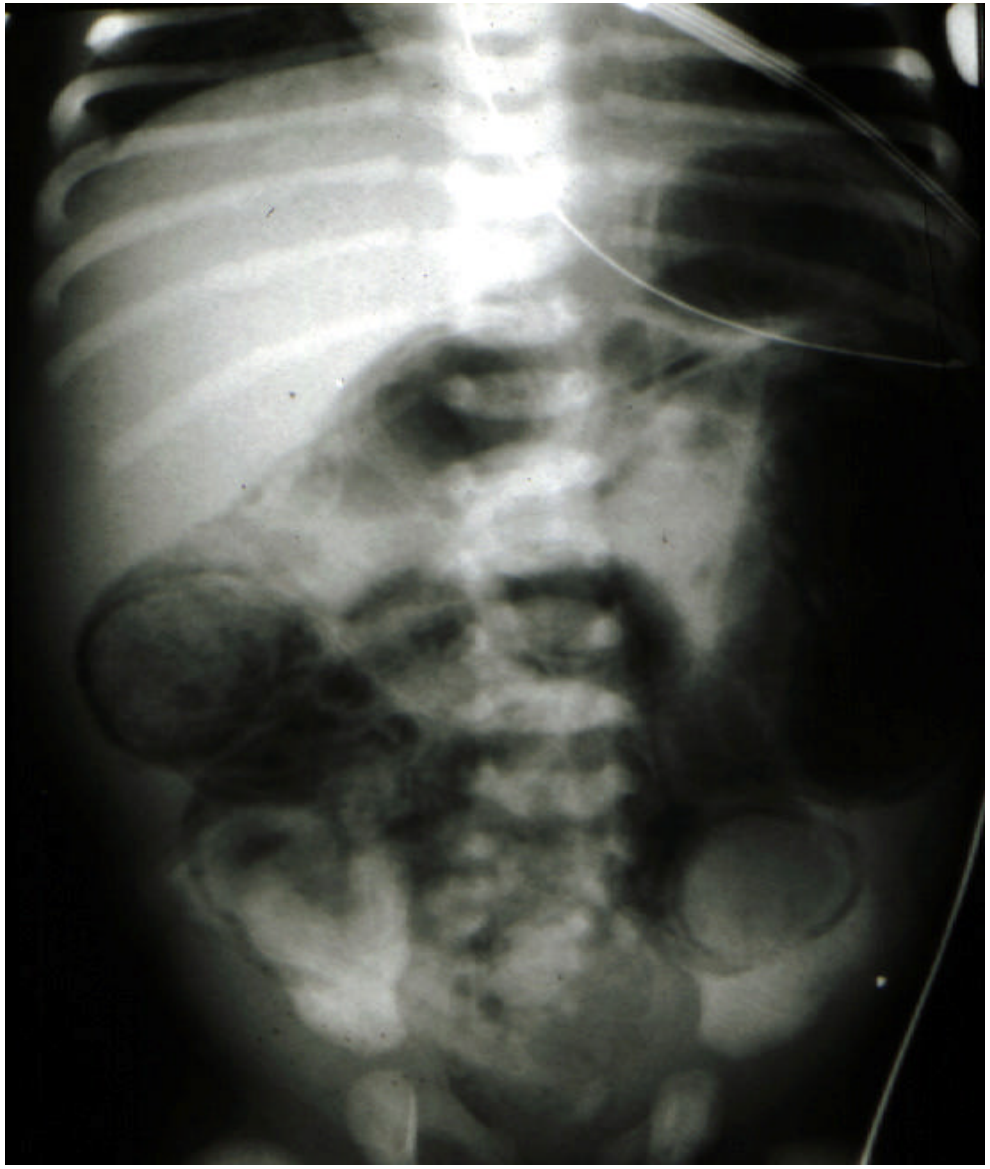
QuickTime?and a
Cinepak decompressor
are needed to see this picture.

The case continued



The case continued

- On day 10 of life, he needed $NaHCO_3$ because of a mild metabolic acidosis. Gastric aspirates increased in volume and were blood tinged. A CBC was remarkable for leukopenia and thrombocytopenia. On day 11, he became distended & developed erythema of the abdominal wall.



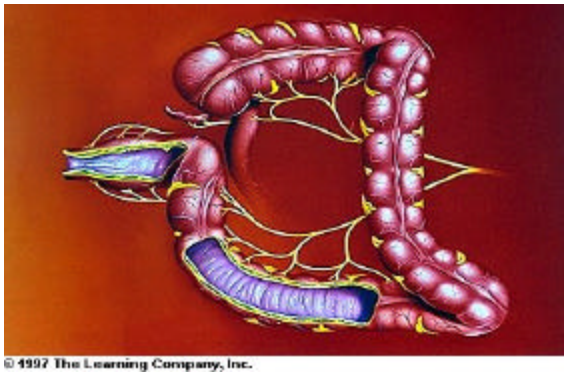
Epidemiology of NEC

- √ Affects 6-8% of VLBW infants
- √ Widely varying incidence between centers
- √ Incidence inversely related to degree of prematurity
- √ No seasonal or sex predilection (? racial effect)

- *Age at diagnosis is inversely related to gestational age and degree of prematurity*

Gestational age*	Age at onset
≤ 30 weeks	20.2 days
31-33 weeks	13.8 days
≥ 34 weeks	5.4 days
Full term	1-3 days

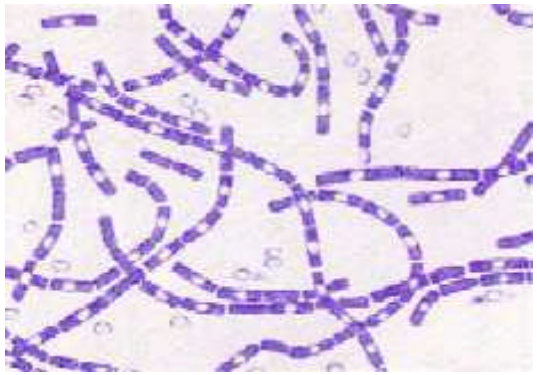
*Stoll et al J Ped. 96: 447, 1980



Vulnerable intestine

Intestinal ischemia
"Diving seal reflex"

+

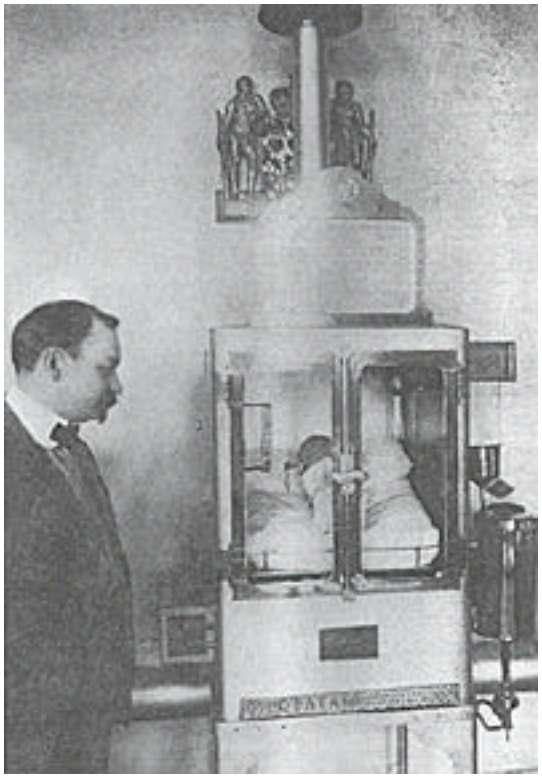


Bacterial Colonization

QuickTime?and a
TIFF (LZW) decompressor
are needed to see this picture.

Formula feeding

Martin Couney



Pathophysiology of NEC

Hypertonic feedings
Overfeeding?
Hypoxia/Ischemia
Cocaine

Breast feeding
Phagocytes
Immunoglobulin
Growth factors
PAF acetylhydrolase

Mucosal Injury

Bacterial Colonization
Bacterial Replication
(+ substrate)
H_2 gas Production
Pneumatosis

Mucosal invasion (endotoxin)

Cytokine production
PAF
TNF/cytokine cascade
Sepsis/shock/SIRS

Diagnosis of NEC

- High index of suspicion based on history and physical findings
- Early appearances are subtle and easily confused with neonatal sepsis.
  - Apnea (pause in breathing)
  - Bradycardia (slowing of heart rate)
  - lethargy
  - temperature instability

Diagnosis and Staging of NEC

Early gastrointestinal findings may be non-specific

- √ Poor motility
- √ Blood in stool
- √ Vomiting
- √ Diarrhea
- √ Guarding
- √ Distension
- √ Feeding intolerance

Diagnosis and Staging of NEC

Later signs reflect progression of illness.

- √ Abdominal tenderness
- √ Abdominal wall erythema
- √ Peritonitis
- √ Ascites
- √ Palpable mass
- √ Hypotension
- √ Bleeding disorders
- √ Acidosis

Classification of NEC

Stage 1: suspect NEC - signs of sepsis, feeding intolerance ± bright red blood per rectum

Stage 2: Proven NEC- all of the above, pneumatosis, ± portal vein gas ± metabolic acidosis ± ascites

Stage 3: Advanced NEC- all of the above, clinical instability, definite ascites ± pneumoperitoneum

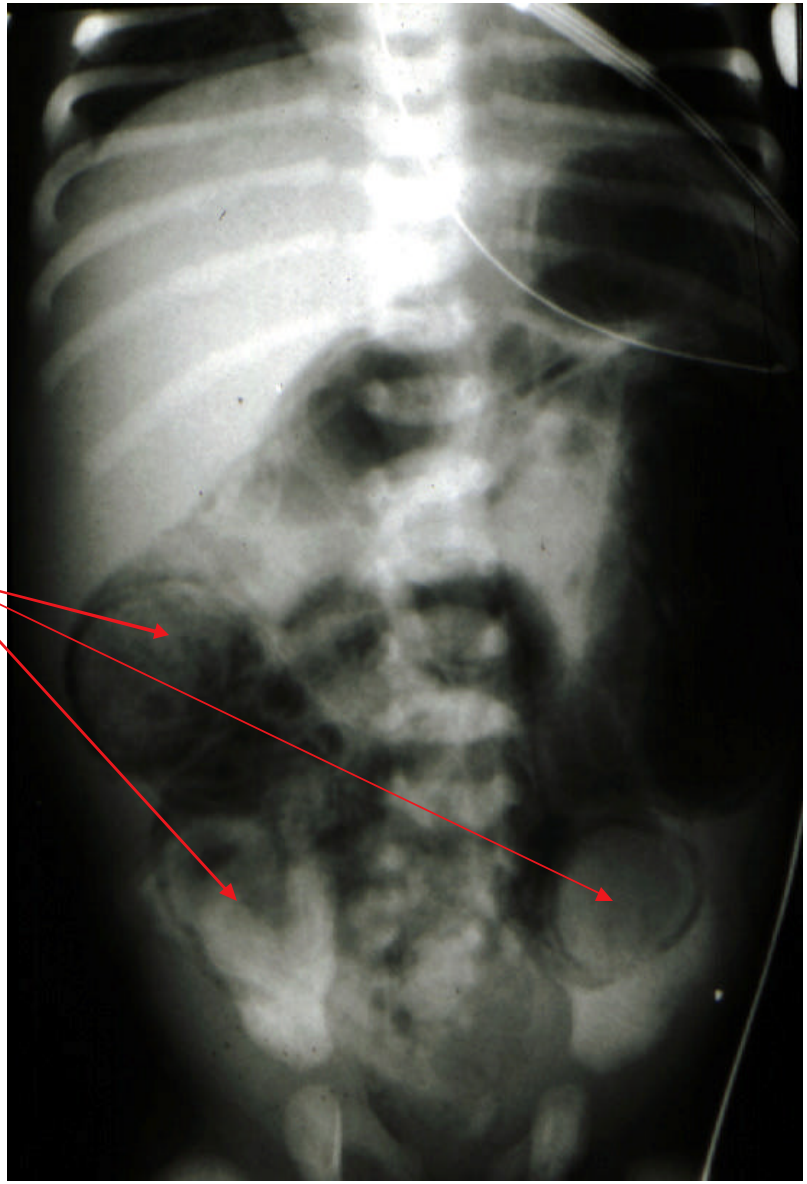
How Do You Make the Diagnosis?

Think of the diagnosis!

- ✓ Serial physical examination
- ✓ Laboratory testing
- ✓ Abdominal x-rays

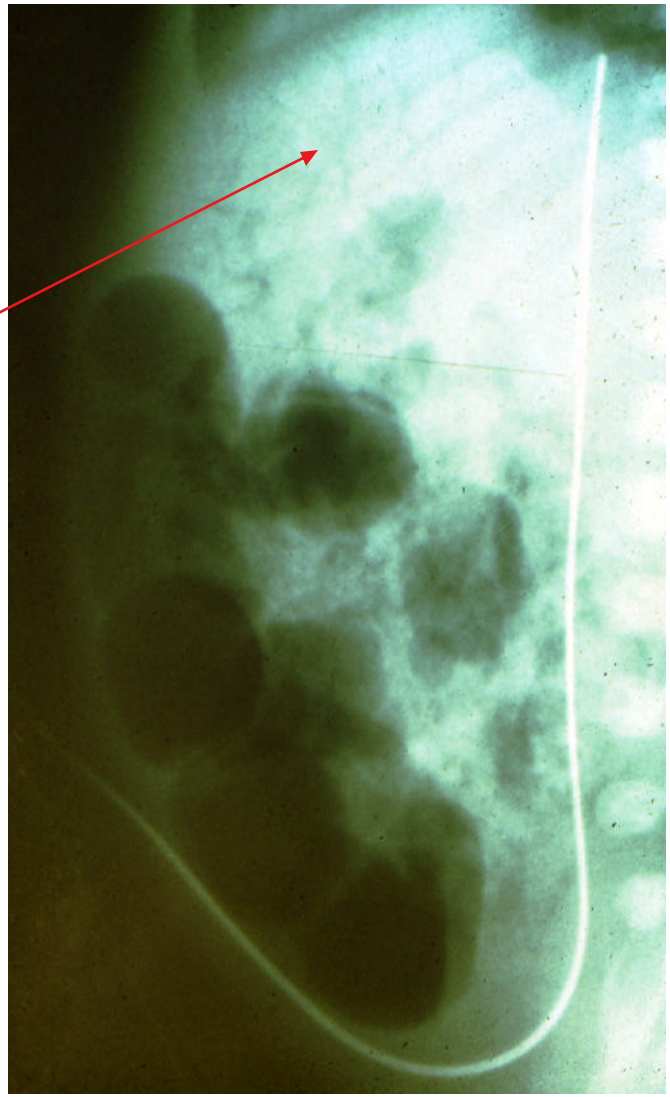
Necrotizing Enterocolitis

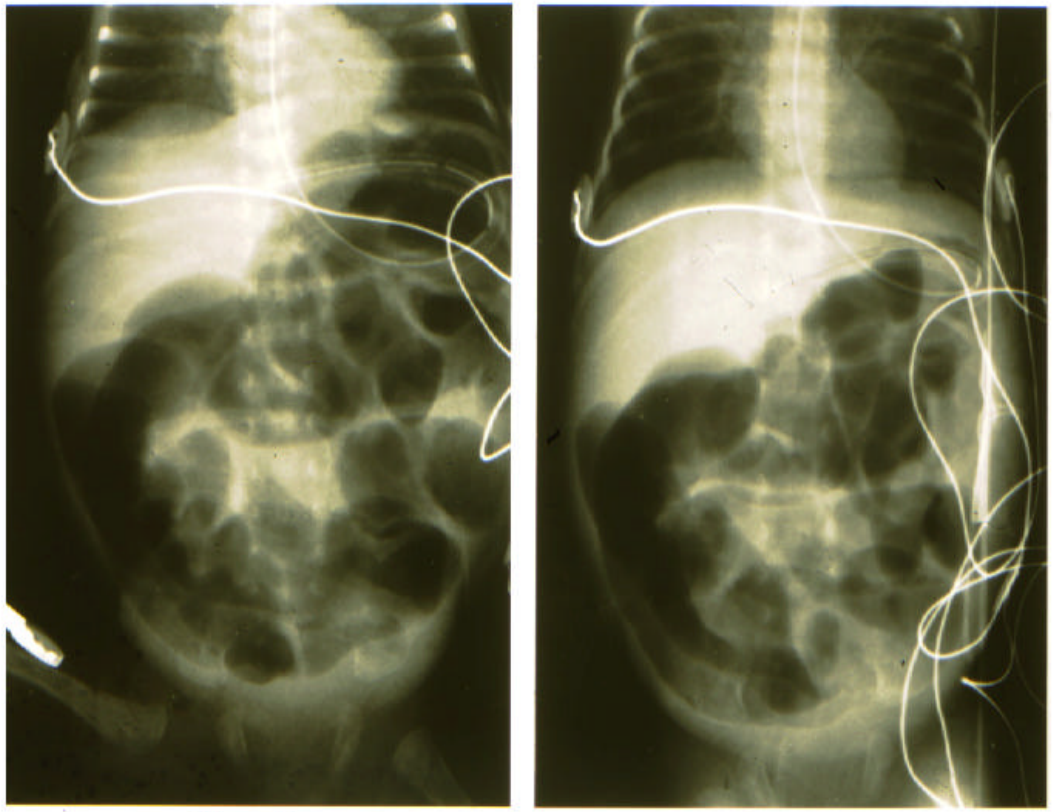
Pneumatosis intestinalis



Necrotizing Enterocolitis

Portal vein gas

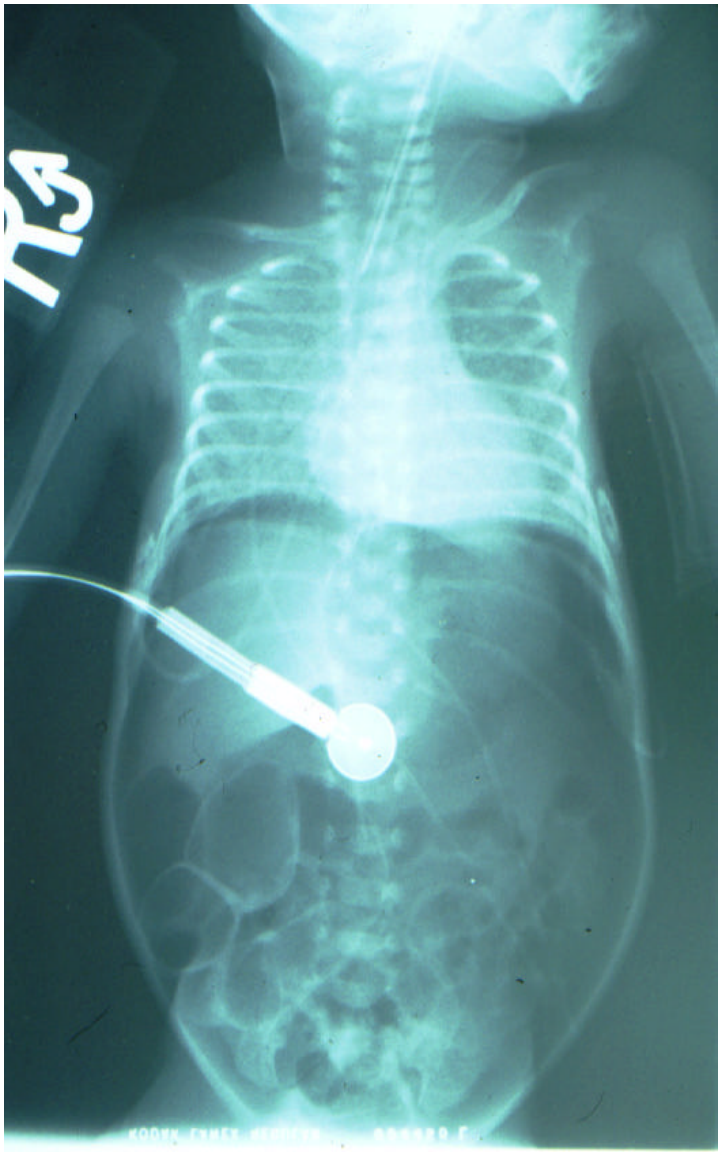




Necrotizing Enterocolitis
Static loops

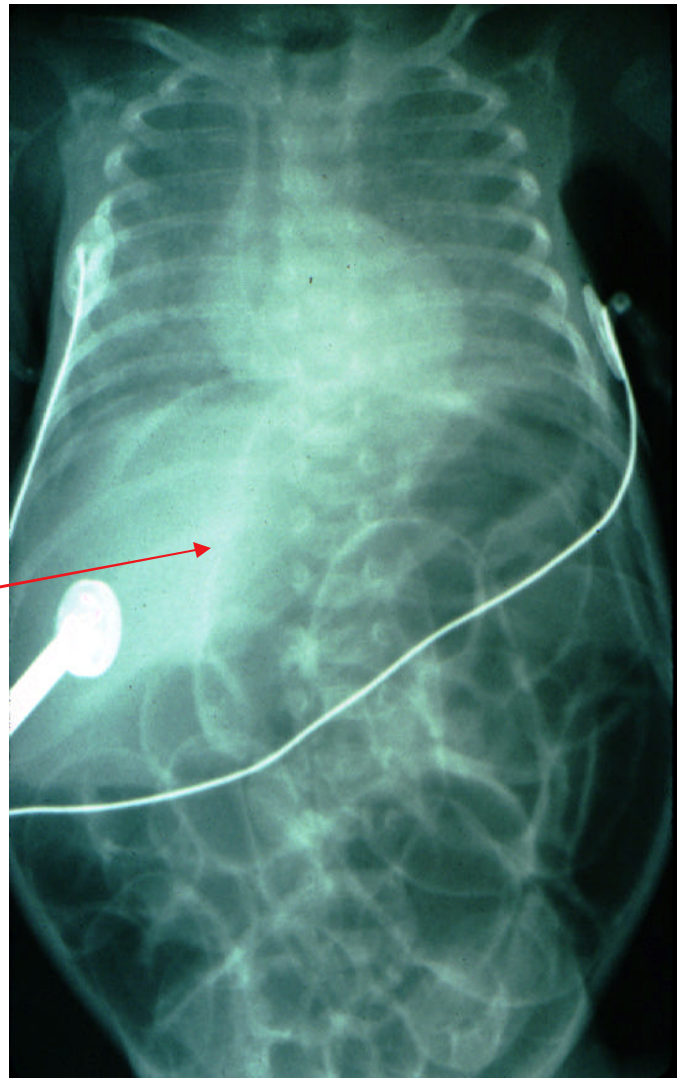
Necrotizing Enterocolitis

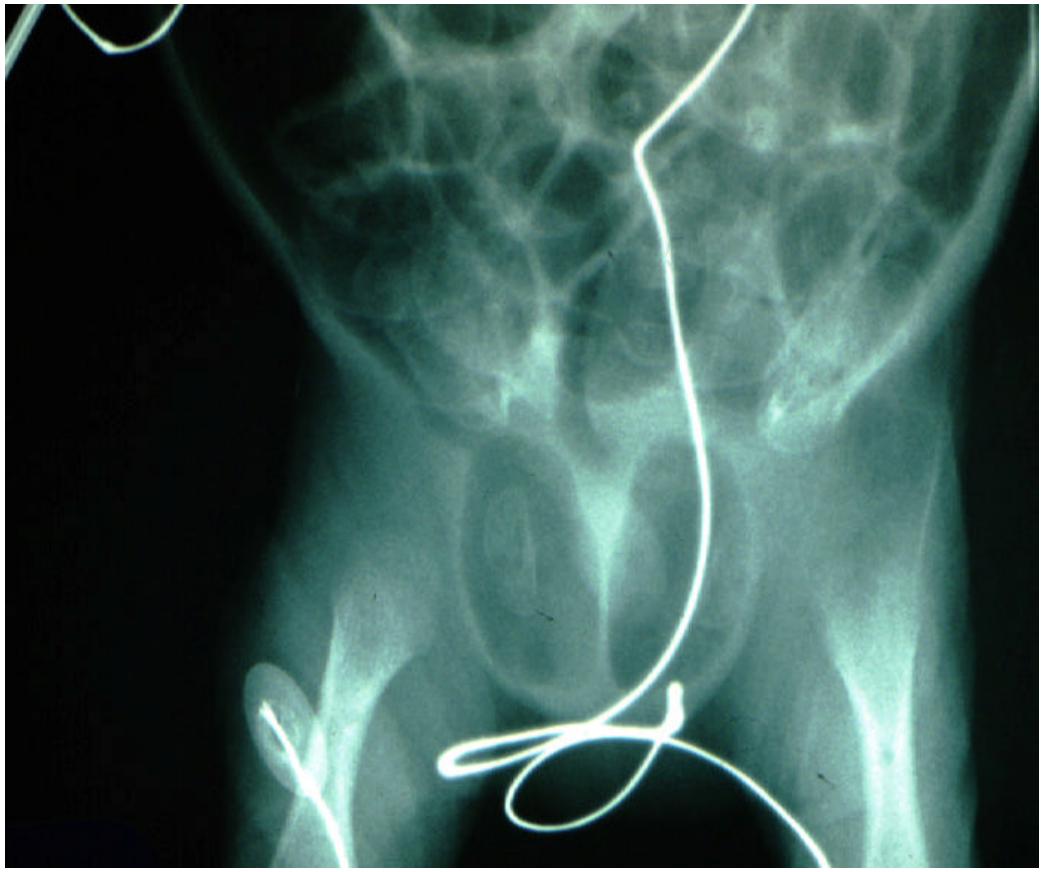
Pneumoperitoneum



Necrotizing Enterocolitis

Pneumoperitoneum
"football" sign





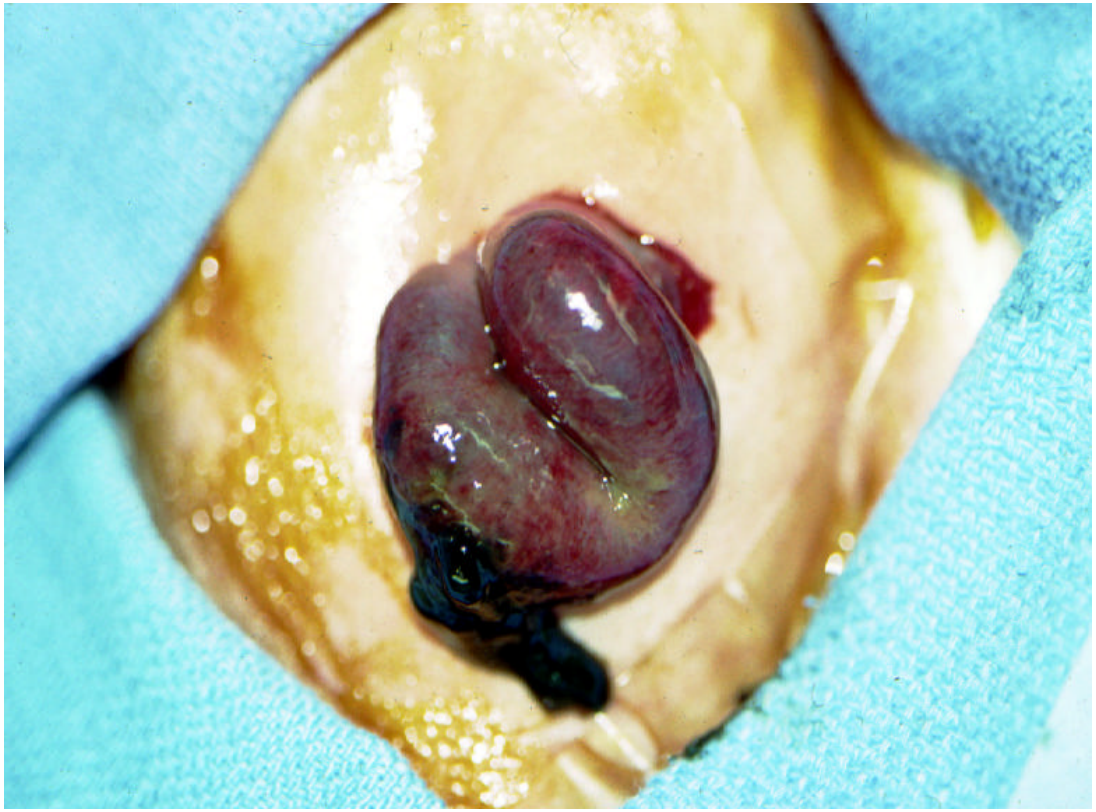
Necrotizing Enterocolitis
Pneumoperitoneum/scrotum

What is the Medical Treatment?

- √ Stop the feedings
- √ Parenteral antibiotics
- √ Nasogastric decompression
- √ Parenteral nutrition
- √ *Fluid* resuscitation

Firm Indications for Surgical Intervention

- ✓ Perforated viscus
- ✓ Abdominal mass
- ✓ Fixed, dilated loop
- ✓ Positive paracentesis



Necrotizing Enterocolitis

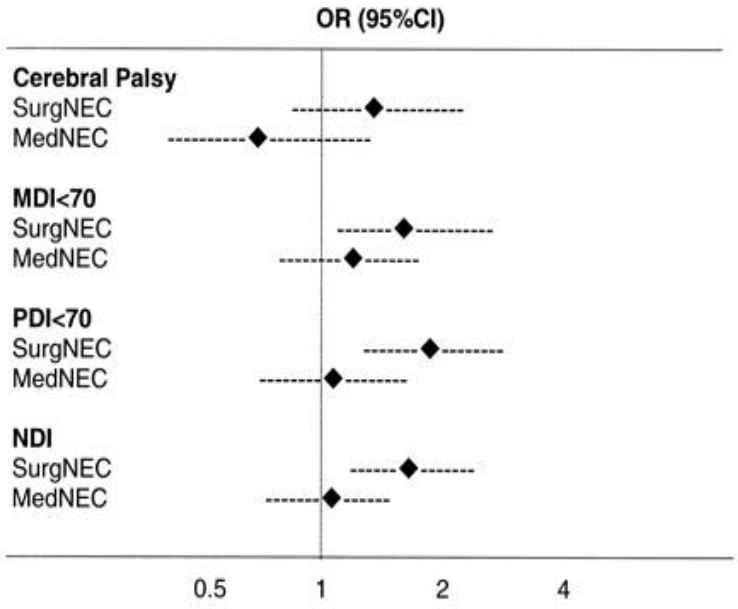
Intestinal gangrene and perforation

What is the outcome?

- √ Infants treated medically survival is > 95%
- √ Infants requiring surgery survival is 70-75%

What is the outcome?

- ✓ Surgical NEC (but not medical NEC) was an independent ri
factor for the combined outcome of neuro-developmental impairment (blindness, deafness, PDI/MDI < 70 or CP)



Hintz SR & the NICHD network Pediatrics 115: 696, 2005

How Can NEC be Prevented?

- ✓ Breast feeding
- ✓ Antenatal steroids
- ✓ Cautious advancement of feedings (perhaps)
- ✓ Cohorting during epidemics
- ✓ Probiotics

Conclusion

- ✓ Prematurity is the single greatest risk factor for NEC & avoidance of premature birth is the best way to prevent NEC
- ✓ The role of feeding in the pathogenesis of NEC is uncertain, but it seems prudent to use breast milk (when available) and advance feedings slowly and cautiously