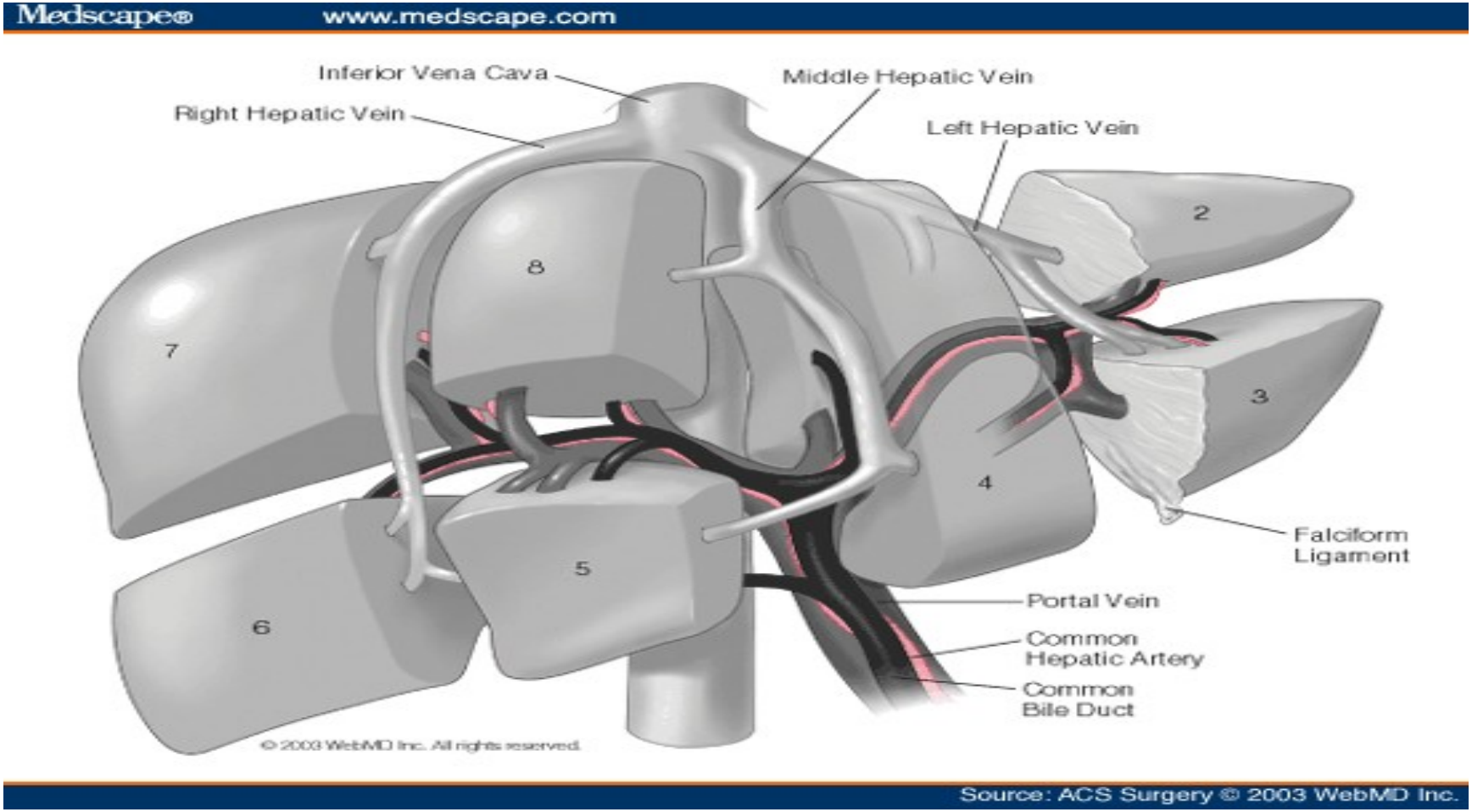
Anesthesia and Liver Disease

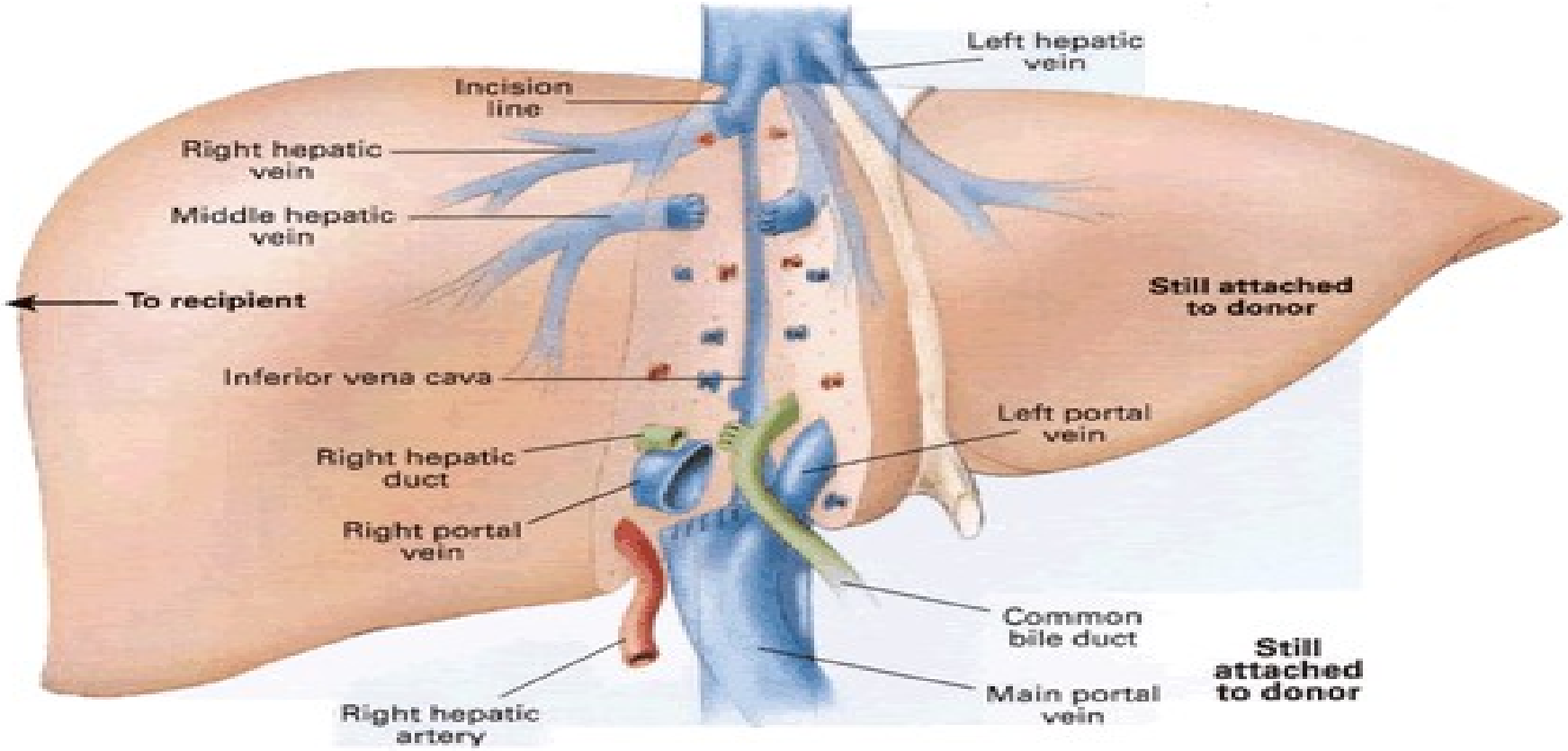
E.A. Steele, MD

May 4, 2005

Liver Anatomy



Liver Anatomy cont.



Trotter, Wachs, Everson, Kam; *Medical Progress: Adult-to-Adult Transplantation of the Right Hepatic Lobe*. The New England Journal of Medicine. April 4, 2002. Vol. 346. Page 1074-1082. Copyright 2002, Massachusetts Medical Society. All rights reserved.

Liver Blood Flow

- Portal Vein
  70% of total flow
  50% of oxygen (only has 85% sat)
  Dependent upon flow thru GI tract
- Hepatic Artery
  30% of total flow
  50% of oxygen
  autoregulated to meet liver demand

Metabolic functions

- Carbohydrate metabolism – glycogen storage
- Fat metabolism – fatty acids
- Protein metabolism – protein deamination to urea, amino acid conversions, plasma protein production
- Drug metabolism
- Other - T4 to T3, vitamin storage

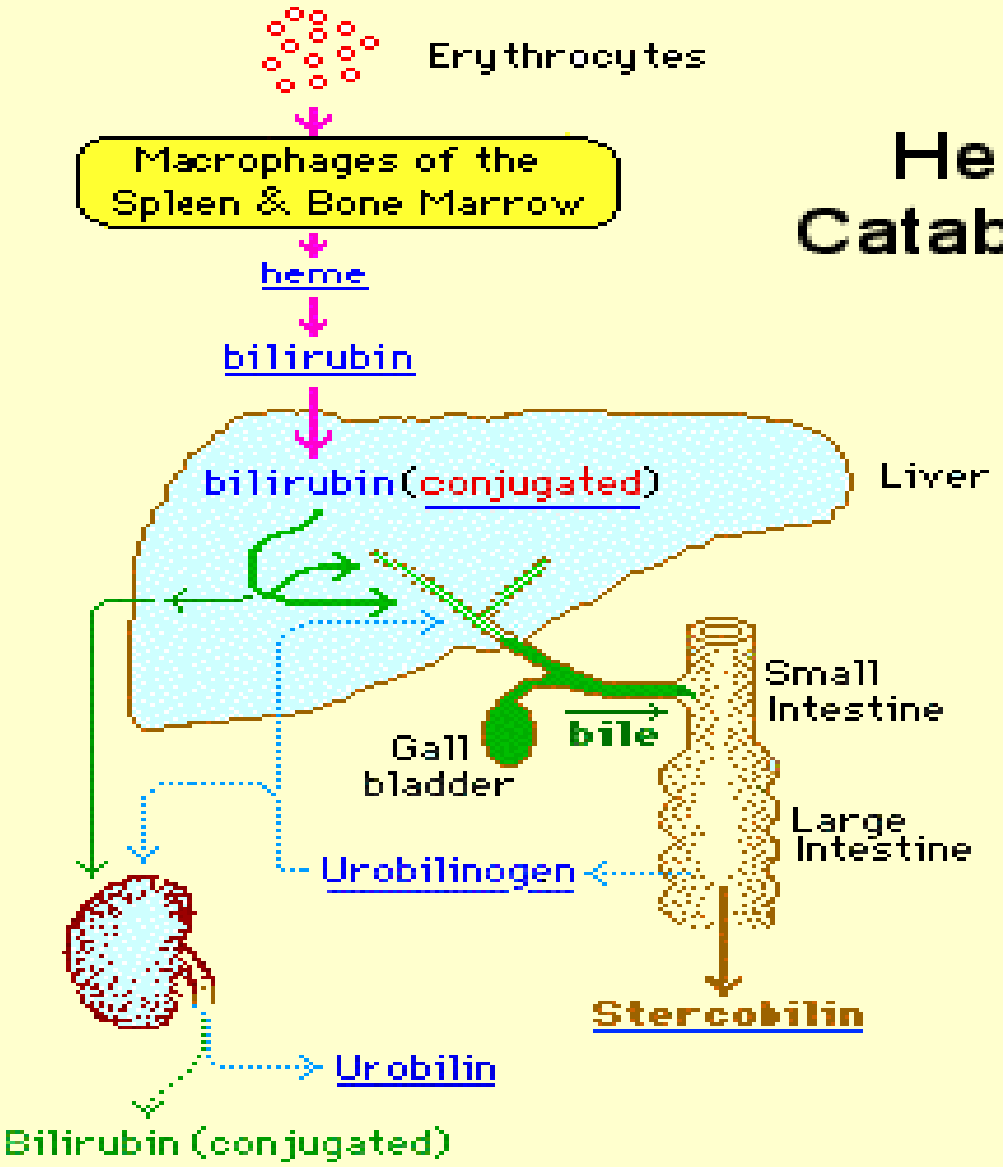
Protein Metabolism

- Deamination – converts a.a. into carbohydrates/fats with ammonia as by-product. Ammonia is toxic
- 2(Ammonia) + CO_2 = urea
- Plasma proteins
  - Albumin, coagulation factors (exc. Factor 8 and vWF), plasma cholinesterases, transport proteins

Bile

- Bile ducts become R & L Hepatic Ducts become hepatic duct, joined by the cystic duct to form the common bile duct to the sphincter of oddi along with the pancreatic duct
- Bile acids for cholesterol elimination and fat absorption (fat soluble vitamins)
- Bilirubin exrection
  - heme – RES – Bilirubin in blood (unconjugated) – liver (conjugated) – excreted in bile mostly, small amt abs in blood or converted in intestines to urobilinogen

Heme Catabolism



Marcel Blanchaer, U. of Manitoba, Canada

Evaluation of liver function

- Large functional reserve of liver, hence there may be significant liver damage before abn. Laboratory tests.
- AST/ALT
- Bilirubin
- Alk Phos
- Albumin
- Ammonia
- Coags

Aminotransferases

- Aspartate aminotransferase (AST=SGOT)
- Alanine aminotransferase (ALT=SGPT)
- Alpocanine aminotransferase (APT=SPOT)

Released from liver cells as they die

Normal levels below 40ish.

Alcohol ALT<AST

Bilirubin

- Unconjugated
  - Hemolysis, congenital defects of conjugation
- Conjugated
  - Hepatocellular dysfunction, obstruction
  - kernicterus
- Total

Albumin

- Low levels
  - Decreased production
    - Liver disease, malnutrition, stress
  - Increased loss
    - Renal, gut

Coagulation

- Protime/INR
  - Fibrinogen, Factors V, VII and X, prothrombin
  - Factor VII has a half-life of 5h, with acute liver injury can see prolongation of PT quickly
  - What's the point of giving FFP the night before surgery? Very little.
  - FFP given just before surgery
  - Vitamin K 12-24h before surgery

Effect of Anesthesia on the Liver

- Hepatic blood flow
  - Decreased portal vein flow
  - Decreased hepatic artery flow (decrease C.O., Decreased MAP)
  - Ventilation (PPV, PEEP)
  - Surgical procedure

Anesthetic effects (cont)

- Biliary function
  - Sphincter of Oddi spasm
    - Glucagon
    - Halothane hepatitis
    - Degree of metabolism
    - Pt. at risk: Female, fat, forty, repeat exposure

Post-op jaundice

Most likely due to pre-operative dysfunction

Drugs (incl OTC and herbals), sepsis, exogenous bilirubin load (old blood), occult hematomas, hemolysis, perioperative events (hypotension, hypoxia), co-morbidities (CHF),

Remote possibilities: “Benign postoperative intrahepatic cholestasis” assoc. with long surgery complicated by hypotension, hypoxemia, massive transfusion; immune-mediated hepatoxicity

Cirrhosis

- Affects all organ systems
- Surgical risk related to degree of hepatic impairment all other things being equal (emergency surgery, type of surgery, comorbidities)

Child-Pugh (or Child-Turcotte)score

- Assigns points (1, 2 or 3) for stigmata of cirrhosis Ascites, bilirubin, albumin, PT/INR, Encephalopathy

Basically, the healthier you are the lower the score. A low score is Grade A – well compensated disease with a 1-2 year patient survival of 85-100%. Grade C, decompensated disease, 1-2 year survival at 35-45%.

This corresponds to perioperative mortality rates of 10, 31 and 76% for increasing Grades.

MELD scores are prob. Similar to Child-Pugh in predicting mortality. Model for end stage liver disease score.

Surgical/Invasive Procedures

- ERCP
- TIPPS
- Cholecystecomy
- Hepatic resection
- Liver transplant