

Approach to the Patient with Abnormal Liver Enzymes

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Overview

Yes:

1. Review of clinical labs and their significance
2. Usual patterns seen in major liver diseases
3. Brief review of the major liver's major functions
4. Brief review of major liver diseases
5. Focused on primary care
6. Interactive

No:

1. In-depth physiology
2. Urgent management
3. How to manage particular liver diseases

Liver Functions

- ▶ Protein synthesis
- ▶ Cholesterol synthesis
- ▶ Metabolic/catabolic functions
 - Bile synthesis and transport
- ▶ Detoxification
- ▶ Factor production

Liver-Related Blood Tests

- ▶ Markers of hepatocyte injury
 - Serum aminotransferases
 - Aspartate aminotransferase (AST)
 - Alanine aminotransferase (ALT)
 - γ -glutamyltransferase (GGT)
 - Alkaline phosphatase (AP)
 - Liver
 - Bone
 - 5'-nucleotidase (5'-NT)*

Liver-Related Blood Tests

- ▶ Test of liver metabolism
 - Total bilirubin
- ▶ Tests of liver synthetic function
 - Serum albumin
 - Prothrombin time

Serum Fibrosis Markers

- Indicators of fibrosis/cirrhosis
- All have limitations
- FIB-4 Score:
 - $(AGE * AST) / (platelets * \sqrt{ALT})$
 - >3.25 sensitive and specific for significant fibrosis
- APRI = AST: Platelets ratio
 - $AST/ASTULN/Platelets$
 - ≥ 1 significant fibrosis likely
- FibroSure
 - >72 significant fibrosis likely

Aminotransferases

- ▶ Formerly called transaminases
- ▶ Included in most routine blood tests
- ▶ Found in:
 - Liver
 - Cardiac muscle
 - Skeletal muscle
 - Kidneys
- ▶ ALT is more specific to the liver
- ▶ ALT and AST normally present at low levels
 - Usually < 30 – 40 u per liter
 - Normal ranges vary widely
 - Sometimes not adjusted for gender

Aminotransferases

- ▶ Normal range is calculated as follows:
 - mean of a group of healthy persons
 - +/- 2 standard deviations
 - 5% of the results fall outside the normal range
 - 2.5% may be >upper level of normal (ULN)
- ▶ An abnormal result may not be indicative of disease
- ▶ Frequently leads to the diagnosis of liver disease
- ▶ Requires a subjective/objective evaluation
- ▶ Damage to cell membrane causes release into serum
 - Necrosis of hepatocyte not required
 - Poor correlation between level and degree¹

Aminotranferases

- ▶ Air force trainee volunteer blood donors (n = 19,877)¹
 - 99 (0.5%) had ALT elevations
 - Etiology was determined in 12 (12%)
 - 4 each = hepatitis B; hepatitis C
 - 2 = autoimmune hepatitis
 - 1 each = cholelithiasis; acute appendicitis
- ▶ Consecutive blood donors with elevated ALT (n = 100)²
 - 48% = alcohol related
 - 22% = fatty liver
 - 17% = hepatitis C
 - 4% = other
 - 9% = no etiology determined

¹Kundrotas 1993

²Katkov 1991

Aminotransferases

- ▶ Elevated ALT with subsequent biopsy (n = 149)³
 - 56% = fatty liver
 - 20% = hepatitis C
 - 11% = alcoholic liver disease
 - 3% = hepatitis B
 - 8% = other causes
 - 2% = no etiology

- ▶ Chronic aminotransferase elevations (n = 1124)⁴
 - 81 (7%) = no etiology found; biopsied
 - 41 (50%) = steatosis
 - 26 (32%) = steatohepatitis
 - 4 (5%) = fibrosis
 - 2 (2%) = cirrhosis
 - 8 (12%) = normal histology

³Hultcrantz 1986

⁴Daniel 1999

Causes of Elevated Aminotransferases

- ▶ Liver-related
 - Alcohol use
 - Viral hepatitis
 - Medication
 - Fatty infiltration
 - Autoimmune hepatitis
 - Hemochromatosis
 - Wilson's Disease
 - α_1 -antitrypsin deficiency
- ▶ Extrahepatic causes
 - Celiac sprue
 - Muscle metabolism disorders
 - Acquired muscle disorders
 - Vigorous exercise

γ -Glutamyltransferase

- ▶ Present in the liver and other tissues
- ▶ Sensitive to bile ducts and/or liver
- ▶ Lacks specificity
 - Elevations associated with:
 - Diabetes
 - Hyperthyroidism
 - COPD
 - Renal failure
 - Alcohol use
 - Certain drugs
 - Confirms a hepatic source of AP elevation

5' Nucleotidase

- ▶ An enzyme found in
 - Liver
 - Intestine, brain, other tissues
- ▶ In liver, similar action to alkaline phosphatase
- ▶ Approximately equal value to AP
- ▶ Determine source of the liver injury
 - Hepatocellular vs cholestatic

Alkaline Phosphatase

- ▶ Enzyme
- ▶ Found in hepatocytes, bone osteoblasts and small intestine
- ▶ Commonly found in serum
- ▶ Can vary by age (higher in older), other factors
- ▶ When elevated, need to confirm hepatic cause
- ▶ ALT:AP ratios are suggestive:
 - < 2 is a hepatocellular pattern
 - $2 - 5$ is a mixed pattern
 - > 5 is a cholestatic pattern

Liver Injury

Cholestasis

- Bile unable to flow from the liver to the duodenum
 - Obstructive
 - Metabolic
- Intrahepatic
- Extrahepatic

Hepatocellular

- Aminotranferases present in high concentrations
- Injury to hepatocyte membrane causes leakage into the serum
- Acute vs chronic

Intrahepatic Causes of Cholestasis

Disease	Diagnostic Test(s)	Clinical Clues
Primary biliary cirrhosis	AMA	Middle-aged women (fatigue, pruritus)
Primary sclerosing cholangitis	MRCP or ERCP	Co-morbid ulcerative colitis
Infiltrative disorders (sarcoid, amyloidosis)	Imaging, biopsy	PMHx tuberculosis, sarcoid, malignancy
Drug induced liver injury (DILI)	Improvement after d/c	Medication history
Sepsis		Relevant history
TPN		Relevant history

Extrahepatic Causes of Cholestasis

Disease	Diagnostic Test(s)	Clinical Clues
Choledolithiasis	Ultrasound ERCP, MRCP	PMHx biliary colic Acute onset RUQ pain Fever, jaundice
Primary sclerosing cholangitis	ERCP	Comorbid ulcerative colitis

Disease	Diagnostic Test(s)	Clinical Clues
Malignancy Pancreatic Cancer Cholangiocarcinoma	Imaging CT or MRI	Presentation with jaundice and weight loss

Hepatic Causes of Acute LFT Elevation

Disease	Aminotransferase Levels	Diagnostic Tests	Clinical Clues
Drug- or toxin-induced (acetaminophen)	Can be > 500	Acetaminophen level	History
Acute viral hepatitis HAV HBV HCV (rare) HDV (HBV) HEV HSV EBV CMV VZV Parvovirus	> 500 ALT > AST	Appropriate viral markers: HBV sAg IgM May not yet have Ab	Risk factor history

Hepatic Causes of Acute LFT Elevation

Disease	Aminotransferase Levels	Diagnostic Tests	Clinical Clues
Ischemic hepatitis	Often > 500 IU/l AST > ALT		Recent hx hypotension
Alcoholic hepatitis	< 400 IU/l AST : ALT > 2:1		<ul style="list-style-type: none">• PMHx excess EtOH• ↑↑t-bilirubin
Acute biliary obstruction	1000 IU/l ALT > AST	Imaging	<ul style="list-style-type: none">• Acute onset RUQ pain• Hx cholelithiasis

Hepatic Causes of Chronic LFT Elevation: Viral Infections

Disease	Aminotransferase Levels	Diagnostic Tests	Clinical Clues
HCV	< 500 IU/l	HCV Ab HCV RNA quant	Risk factor(s)
HBV	ALT > AST	HBVsAg HBV DNA	Risk factor(s)
HDV (in HBV)		HDV Ab	

Hepatic Causes of Chronic LFT Elevation

Disease	Aminotransferase Levels	Diagnostic Tests	Clinical Clues
Alcoholic liver disease	< 400 IU/l AST:ALT >2:1		Relevant history
Nonalcoholic fatty liver disease	< 300 IU/l ALT>AST		<ul style="list-style-type: none"> • Comorbid metabolic syndrome • Predisposition
Drug induced liver injury (DILI)	Up to 2000 IU/l ALT>AST	Improvement after d/c	Relevant history
Autoimmune hepatitis	Up to 2000 IU/l ALT>AST	ANA, ASMA, IgG levels	<ul style="list-style-type: none"> • Usually women • Age 30 – 50 • Comorbid autoimmune disease

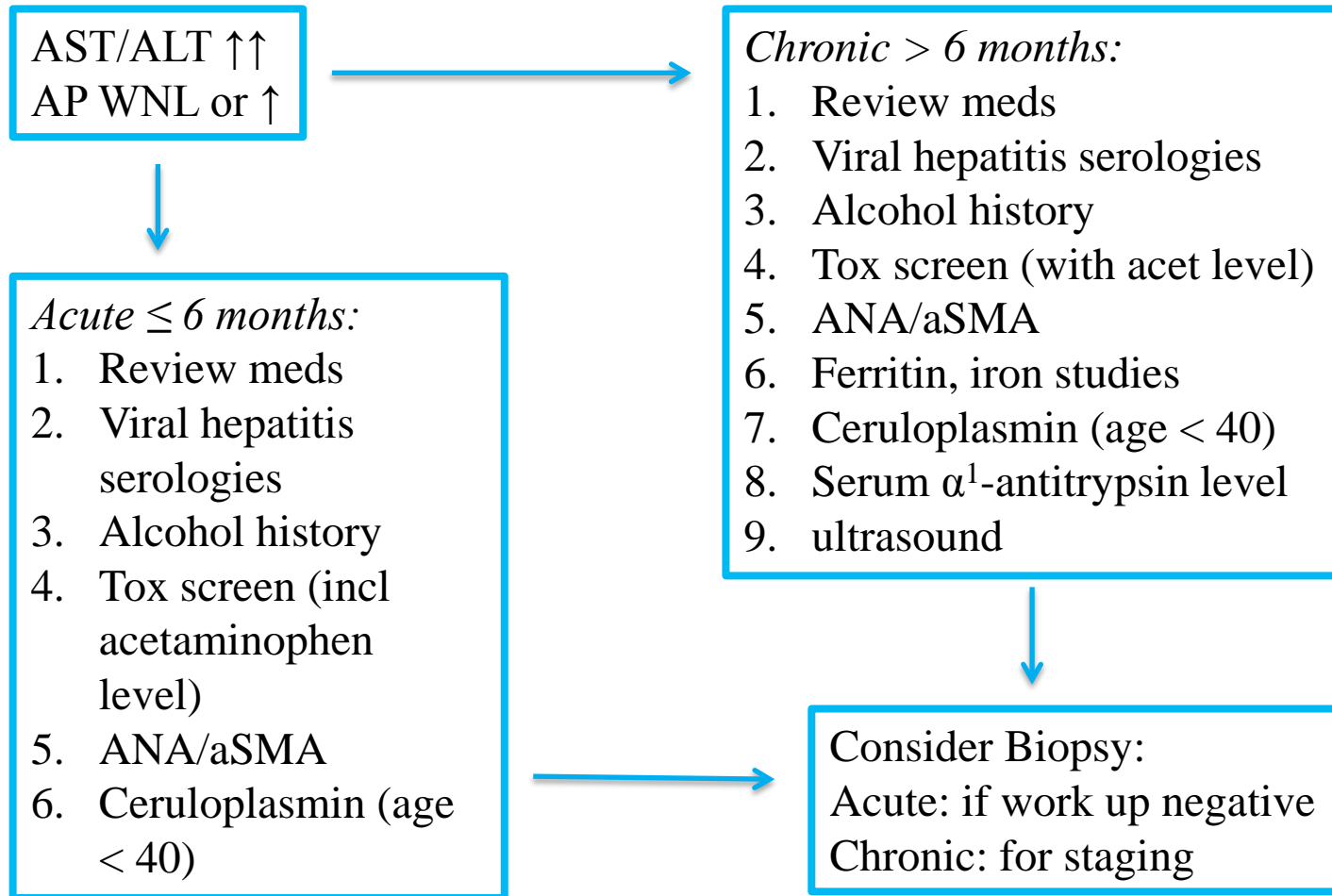
Hepatic Causes of Chronic LFT Elevation

Disease	Aminotransferase Levels	Diagnostic Tests	Clinical Clues
Hereditary hemochromatosis	<200 IU/l ALT>AST	Ferritin Iron saturation IgG levels	Family history
Wilson disease	Up to 2000 IU/l ALT>AST	Ceruloplasmin 24h urine copper Slit lamp exam	Age < 40 Low serum AP
α_1 -antitrypsin deficiency	<100 IU/l	α_1 -antitrypsin level	Family hx Early onset lung disease
Infiltrative disease	<500 IU/l ALT>AST	Imaging Biopsy	
Cirrhosis <ul style="list-style-type: none"> any cause cryptogenic 	<300 IU/l AST>ALT		Platelets < 150,000 Signs of portal hypertension

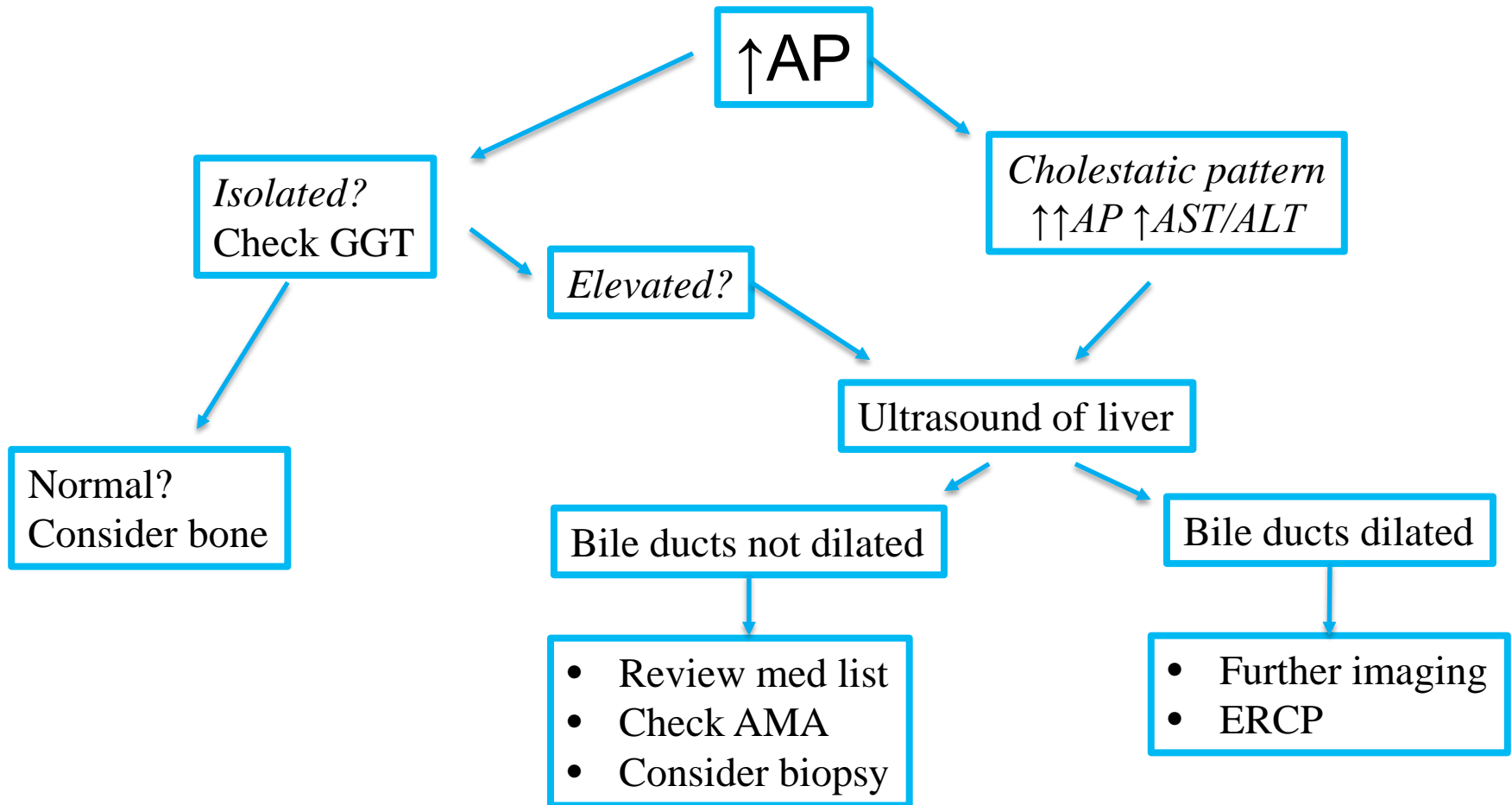
Usual Patterns

Disease Category	Amino-transferases	Alkaline Phosphatase
Hepatocellular	↑↑	↑
Cholestatic	↑	↑↑

Hepatocellular Pattern: Work up



Cholestatic Pattern: Work up



Take a Careful History

- ▶ Viral hepatitis (B and C)
 - Up to 75% unaware of diagnosis
 - No acute event or symptoms in most cases
 - Long asymptomatic course
 - Are motivated by stigma not to disclose
 - May believe that a single remote event could not be problematic
 - Risk factors vs endemic areas
 - Unaware of family history

Take a Careful History

- ▶ Alcohol
 - Fear of repercussion/implications of disclosure
 - Family history can be a clue
 - Minimization is common
 - Quantities

Take a Careful History

- ▶ Drug induced liver injury
 - Concomitant use of meds
 - Acetaminophen overdose can be inadvertent
 - Recent viral illness?
 - Arthralgias

First Steps

- ▶ Is the elevation physiologic or transient?
- ▶ Alkaline phosphatase can be increased in
 - Pregnancy 3rd trimester
 - Bone metabolism (post menopausal)
- ▶ Repeating the tests for confirmation is almost always indicated

Viral Hepatitis

- ▶ Risk factor based screening
 - Depends on history taking
 - Patient/provider relationship
 - Careful/thoughtful questioning
 - Once diagnosed, history may be less important
- ▶ Elevated liver enzymes is a risk factor for viral hepatitis
- ▶ Shared risk factors: usually makes sense to check them all.

Acute hepatitis A

- ▶ Foodborne
 - Ask about recent travel
 - Other potential food sources
- ▶ Check total Ab
- ▶ If positive or with higher suspicion, check IGM
- ▶ Rarely becomes chronic
- ▶ Consider vaccination if Ab- and ongoing risk

Hepatitis B

- ▶ Common in Asian, African, Caribbean populations
- ▶ Ask about family history of liver disease, cancer
- ▶ May have been exposed with either
 - No chronic infection
 - Inactive disease
- ▶ Check the following:
 - HBV cAb
 - HBV sAb
 - HBV sAg (if +, chronically infected)
- ▶ Consider vaccination

Hepatitis C

- ▶ Most common bloodborne disease worldwide (3%)¹
- ▶ Up to 75% unaware of their infection
- ▶ Risk factors vary
 - North America, Western Europe, etc: injected or nasal drug use (active or historical)
 - Worldwide: unsafe therapeutic injections
 - Highest rate: Egypt (~20%)
- ▶ Check HCV Ab, confirm + with HCV RNA(quant)

Alcoholic Liver Disease

- ▶ Concealing or minimizing alcohol (EtOH) use
- ▶ AST:ALT ratio $\geq 2:1$ ¹
 - Relatively low serum activity of ALT in EtOH use
 - GGT is often also increased
- ▶ Usually chronic problem
- ▶ Characterized by relapse
- ▶ Requires counseling, referral

¹Cohen 1979

Drug-Induced Liver Injury

- ▶ Most common: acetaminophen
- ▶ Almost any drug can cause an elevation
- ▶ Supplements, herbs, homeopathic treatments
- ▶ Risk of acute liver failure
- ▶ Medications recently started
 - Risk benefit assessment
 - Hold medication and assess response
 - Continue close monitoring for essential medications
 - Consultation may be needed

Drugs/Herbs Associated with DILI¹

Drugs

- ▶ Acetaminophen
- ▶ Isoniazid
- ▶ Antibiotics
 - Penicillins
 - Ciprofloxacin
 - Nitrofurantoin
 - -azoles
 - Isoniazid
- ▶ Antiepileptics
 - Phenytoin
 - Carbamazepine
- ▶ Statins
- ▶ NSAIDs
- ▶ Sulfonylureas

Herbs

- ▶ Chaparral
- ▶ Chinese herbs
- ▶ Gentian
- ▶ Germander
- ▶ Alchemilla
- ▶ Senna
- ▶ Shark cartilage
- ▶ Scutellaria

Drugs of abuse

- ▶ Anabolic steroids
- ▶ Cocaine
- ▶ “Meth”
- ▶ “Angel dust”
- ▶ Glues/solvents
 - Toluene
 - chloroform

Autoimmune Hepatitis¹

- ▶ Female : Male = 4:1
- ▶ Young to middle age
- ▶ Diagnostic criteria
 - Elevated aminotranferases
 - Absence of other causes
 - Presence of serologic characteristics
 - Polyclonal immunoglobulins (>2xULN)
 - Hypergammaglobulinemia (>80%)
 - ANA, ASMA, others (low sensitivity)
 - Confirmed with biopsy

¹Krawitt 1999, Manns 1984, Czaja 1988

Fatty Liver

- ▶ Non-alcoholic Fatty Liver Disease (NAFLD), Non-alcoholic Fatty Liver (NAFL), Hepatic Steatosis, Non-alcoholic Steatohepatitis (NASH)
- ▶ Increasing in incidence
- ▶ Projected to become leading transplant indication
- ▶ Elevated ALT/AST may be the only sign
 - Usually less than 4xULN
 - AST:ALT < 1:1 (vs EtOH)
- ▶ Confirm with ultrasound (or CT)
- ▶ Diagnosis of NASH requires biopsy (vs MRI)
- ▶ NASH is typically more progressive
- ▶ Weight loss is cornerstone of therapy
- ▶ Vitamin E, medical therapy are controversial

Hemochromatosis

- ▶ Iron overload
- ▶ Genetic disorder
- ▶ Screening labs:
 - Serum iron
 - Iron binding capacity
 - Serum ferritin
 - Transferrin saturation (Fe/TIBC) >45%
 - Genetic marker: HFE
- ▶ Confirmed with biopsy
 - Genetic marker +, LFT's WNL, age <40 = no bx

Wilson's Disease

- ▶ Biliary copper excretion disorder
- ▶ Genetic (no genetic test)
- ▶ My cause elevated ALT/AST
- ▶ Usual onset ages 5 – 25
- ▶ Consider up to age 40
- ▶ Labs:
 - Serum ceruloplasmin: reduced in ~85%
 - 24-hour quant urine: $\text{cu} > 100\mu\text{g}/24$ hours
- ▶ Biopsy: $>250\mu\text{g cu/g}$
- ▶ Kaiser-Fleischer rings

α_1 -Antitrypsin Deficiency

- ▶ Uncommon cause of LFT elevation
- ▶ Under-recognized
- ▶ Diagnosed by phenotyping
- ▶ Inherited disorder
- ▶ Involves lung, liver, sometimes skin
- ▶ Consider after all other causes have been ruled out

Celiac Sprue

- ▶ Small bowel disorder
- ▶ Causes inflammation
- ▶ Improves with removal of dietary gluten
- ▶ Elevated aminotransferases can be among a large number of findings
- ▶ Can be associated with primary biliary cirrhosis

Other Non-hepatic Causes

- ▶ Strenuous exercise
- ▶ Muscle:
 - Inherited disorders
 - Polymyositis

Still No Identified Cause?

- ▶ If $<2xULN$ and no identified cause: monitor
- ▶ If persistently $>2xULN$: consider biopsy
 - Rarely lead to a diagnosis
 - Rarely change management
 - Can rule out causes/reassure
 - Risk/benefit analysis

Transient Elastography

- Measures liver stiffness
- Non-invasive
- Office procedure
- Score correlates with degree of fibrosis
- More sensitive at high and low ends



42 yo male

HCV/EtOH cirrhosis

Laboratory Results			
Component	Latest Ref Rng	2/27/2013	3/11/2014
		2:15 PM	2:58 PM
ALBUMIN	3.5 - 4.9 G/DL	3.5	3.5
BILIRUBIN TOTAL	0.1 - 1.2 MG/DL	1.2	1.2
CALCIUM	8.5 - 10.5 MG/DL	8.3 (L)	8.7
CHLORIDE	96 - 108 MEQ/L	108	107
CREATININE	0.70 - 1.40 MG/DL	0.92	1.12
GLUCOSE	65 - 139 MG/DL	77	74
ALK.PHOSPHATASE	30 - 110 U/L	118 (H)	113 (H)
POTASSIUM	3.5 - 5.0 MEQ/L	3.9	3.9
PROTEIN TOTAL	6.0 - 8.3 G/DL	6.8	6.8
SODIUM	135 - 145 MEQ/L	139	140
AST (SGOT)	1 - 50 U/L	60 (H)	80 (H)
UREA NITROGEN	11 - 25 MG/DL	12	12
CO2 TOTAL	22.0 - 32.0 MEQ/L	23.3	22.6
ALT(SGPT)	1 - 53 U/L	62 (H)	89 (H)
EGFR AFRICAN AM	ml/min/1.73m	>60.00	>60.00
EGFR NON-AFR AM	ml/min/1.73m	>60.00	>60.00

72 yo female

PBC/decompensated cirrhosis (EV)

Laboratory Results

Component	Latest Ref Rng	1/27/2009	8/4/2009	8/31/2010	9/1/2010	9/2/2010	9/21/2010	12/19/2013	3/18/2014
		1:20 PM	9:58 AM	4:19 AM	6:30 AM	4:41 AM	10:01 AM	11:54 AM	9:04 AM
GLUCOSE	65 - 139 MG/DL	85	77	86	87	80	81	80	94
SODIUM	135 - 145 MEQ/L	140	143	143	141	143	142	141	142
POTASSIUM	3.5 - 5.0 MEQ/L	3.8	4.0	4.9	3.3 (L)	3.6	4.7	4.0	3.8
CHLORIDE	96 - 108 MEQ/L	105	106	111 (H)	112 (H)	113 (H)	106	104	104
CO2 TOTAL	22.0 - 32.0 MEQ/L	28.4	28.2	23.6	21.9 (L)	23.5	28.8	27.0	26.1
UREA NITROGEN	10 - 30 MG/DL	16	13	22	14	8 (L)	14	18	17
CREATININE	0.60 - 1.40 MG/DL	0.6	0.6	0.7	0.7	0.6	0.7	0.73	0.75
PHOSPHORUS	2.4 - 4.7 MG/DL	3.2	2.5	3.7	1.8 (L)	2.2 (L)	3.0	3.7	2.5
PROTEIN TOTAL	6.0 - 8.3 G/DL	7.2	7.3	5.0 (L)	4.9 (L)	4.9 (L)	7.7	7.1	7.5
ALBUMIN	3.5 - 4.9 G/DL	3.6	3.7	2.4 (L)	2.4 (L)	2.4 (L)	3.4 (L)	3.5	3.4 (L)
CALCIUM	8.5 - 10.5 MG/DL	9.1	9.1	7.6 (L)	6.8 (L)	6.9 (L)	9.2	9.3	8.7
ALK.PHOSPHATASE	30 - 110 U/L	140 (H)	127 (H)	86	81	80	109	102	120 (H)
ALT(SGPT)	1 - 53 U/L	34	32	26	54 (H)	56 (H)	23	26	29
AST (SGOT)	1 - 50 U/L	56 (H)	59 (H)	51 (H)	116 (H)	114 (H)	58 (H)	52 (H)	70 (H)
GAMMA GT	8 - 35 U/L	34	28	18	16	14	33	22	30
BILIRUBIN TOTAL	0.1 - 1.2 MG/DL	1.8 (H)	1.8 (H)	1.5 (H)	3.5 (H)	2.5 (H)	2.0 (H)	2.5 (H)	2.2 (H)
BILIRUBIN DIRECT	0.0 - 0.8 MG/DL	1.2 (H)	0.9 (H)	1.0 (H)	2.4 (H)	1.7 (H)	1.1 (H)	1.4 (H)	1.3 (H)
LD(LDH)	100 - 220 U/L	190	229 (H)	206	220	224 (H)	251 (H)	232 (H)	227 (H)
AMYLASE	30 - 300 U/L	53	56	31	33	41	101	72	80
MAGNESIUM	1.5 - 2.5 MG/DL	2.0	2.0	1.5	1.4 (L)	1.8	2.0	1.9	1.8

43 year old female, chronic HBV on treatment

Laboratory Results

Component	Latest Ref Rng	10/6/2011	12/13/2011	12/4/2012	3/5/2013	6/4/2013	9/3/2013	11/26/2013	2/25/2014
		5:28 PM	3:19 PM	12:49 PM	11:20 AM	10:58 AM	11:39 AM	12:53 PM	12:57 PM
ALBUMIN	3.5 - 4.9 G/DL	4.6	3.9	4.1	3.9	4.5	3.9	4.2	4.1
BILIRUBIN TOTAL	0.1 - 1.2 MG/DL	0.3	0.2	0.2	0.2	0.4	0.2	0.2	0.2
CALCIUM	8.5 - 10.5 MG/DL	9.8	9.6	10.0	9.3	9.3	9.0	9.5	10.2
CHLORIDE	96 - 108 MEQ/L	105	103	107	106	108	105	106	103
CREATININE	0.50 - 1.30 MG/DL	0.80	0.81	0.83	0.77	0.92	0.81	0.69	0.84
GLUCOSE	65 - 139 MG/DL	63 (L)	76	80	75	76	96	89	81
ALK.PHOSPHATASE	30 - 110 U/L	52	47	42	37	47	50	42	38
POTASSIUM	3.5 - 5.0 MEQ/L	4.1	4.1	4.3	4.6	4.6	4.2	4.2	4.5
PROTEIN TOTAL	6.0 - 8.3 G/DL	7.6	7.3	7.3	6.7	7.3	6.9	6.7	7.1
SODIUM	135 - 145 MEQ/L	142	138	141	141	143	139	139	138
AST (SGOT)	1 - 50 U/L	38	35	34	23	23	26	20	27
UREA NITROGEN	8 - 24 MG/DL	10	11	14	12	8	8	9	13
CO2 TOTAL	22.0 - 32.0 MEQ/L	27.1	24.7	23.5	22.9	25.3	26.5	22.6	25.2
ALT(SGPT)	1 - 53 U/L	44	41	31	18	20	21	16	22
EGFR AFRICAN AM	ml/min/1.73m	>60.00	>60.00	>60.00	>60.00	>60.00	>60.00	>60.00	>60.00
EGFR NON-AFR AM	ml/min/1.73m	>60.00	>60.00	>60.00	>60.00	>60.00	>60.00	>60.00	>60.00

Laboratory Results

Component	Latest Ref Rng	10/6/2011	12/13/2011	5/29/2012	9/11/2012	3/5/2013	6/4/2013	9/3/2013	11/26/2013	2/25/2014
		5:29 PM	2:50 PM	2:54 PM	1:49 PM	11:31 AM	10:58 AM	11:39 AM	1:07 PM	1:22 PM
HBV DNA QUANT. PCR	Not Detected IU/ml	1,788 (A)	59 (A)	30 (A)	43 (A)	NOT DETECTED	NOT DETECTED	Not Detected	< 20 DETECTED (A)	Not Detected

69 yo female chronic HCV, Remotely infected,
Nonresponse x 1, currently on TW 3

Laboratory Results					
Component	Latest Ref Rng	4/16/2013	4/17/2013	4/18/2013	11/25/2013
		3:43 AM	4:56 AM	3:18 AM	9:59 AM
ALBUMIN	3.5 - 4.9 G/DL	2.8 (L)	3.0 (L)	3.1 (L)	3.7
BILIRUBIN TOTAL	0.1 - 1.2 MG/DL	0.6	0.4	0.5	0.3
CALCIUM	8.5 - 10.5 MG/DL	8.1 (L)	8.6	9.2	9.3
CHLORIDE	96 - 108 MEQ/L	105	101	104	106
CREATININE	0.60 - 1.40 MG/DL	0.89	0.73	0.76	0.86
GLUCOSE	65 - 139 MG/DL	117	101	103	82
ALK.PHOSPHATASE	30 - 110 U/L	84	80	77	94
POTASSIUM	3.5 - 5.0 MEQ/L	4.1	4.2	4.4	4.8
PROTEIN TOTAL	6.0 - 8.3 G/DL	5.9 (L)	6.1	6.3	7.3
SODIUM	135 - 145 MEQ/L	138	138	139	143
AST (SGOT)	1 - 50 U/L	19	18	18	16
UREA NITROGEN	10 - 30 MG/DL	9 (L)	6 (L)	9 (L)	9 (L)
CO2 TOTAL	22.0 - 32.0 MEQ/L	27.4	28.1	28.6	28.1
ALT(SGPT)	1 - 53 U/L	12	11	13	9
EGFR AFRICAN AM	ml/min/1.73m	>60.00	>60.00	>60.00	>60.00
EGFR NON-AFR AM	ml/min/1.73m	>60.00	>60.00	>60.00	>60.00

84 yo male polycystic liver disease

Laboratory Results			
Component	Latest Ref Rng	6/8/2011	6/21/2012
		2:26 PM	8:04 PM
ALBUMIN	3.5 - 4.9 G/DL	4.1	4.3
BILIRUBIN TOTAL	0.1 - 1.2 MG/DL	0.2	0.2
CALCIUM	8.5 - 10.5 MG/DL	9.8	9.8
CHLORIDE	96 - 108 MEQ/L	105	106
CREATININE	0.70 - 1.40 MG/DL	0.90	0.87
GLUCOSE	65 - 139 MG/DL	66	85
ALK.PHOSPHATASE	30 - 110 U/L	67	69
POTASSIUM	3.5 - 5.0 MEQ/L	4.5	4.8
PROTEIN TOTAL	6.0 - 8.3 G/DL	7.2	7.3
SODIUM	135 - 145 MEQ/L	143	143
AST (SGOT)	1 - 50 U/L	29	26
UREA NITROGEN	10 - 30 MG/DL	14	19
CO2 TOTAL	22.0 - 32.0 MEQ/L	26.9	27.8
ALT(SGPT)	1 - 53 U/L	24	17
EGFR AFRICAN AM	ml/min/1.73m		>60.00
EGFR NON-AFR AM	ml/min/1.73m		>60.00



References

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Thank you