

Interpreting Liver blood tests

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Welsh Paediatric Society Autumn Clinical Meeting

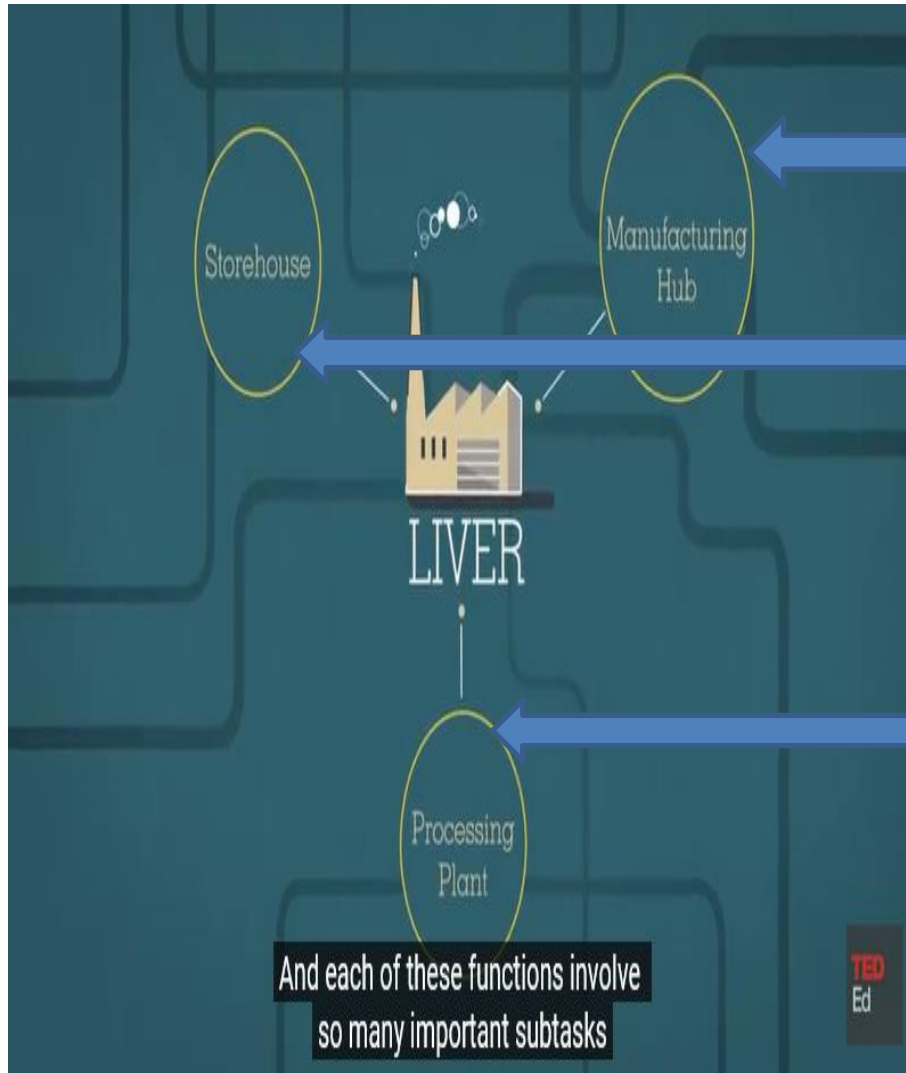
09/11/2024

Outline of the talk

- What does Liver do and what tests to request to diagnose liver dysfunction
- How to interpret abnormal liver blood tests
- When to refer to paediatric hepatologist
- Blood tests for etiological diagnosis
- Monitoring tests for liver diseases

Case studies

Functions of the Liver



- Makes clotting factors
 - Makes protein- albumin
 - Makes Bile which flows to intestine
- Stores glucose and releases when required
- Detoxifies Ammonia
 - Conjugates bilirubin
 - Clears lactate
 - **Transaminases**
 - **GGT in the biliary epithelium**

Liver Function tests

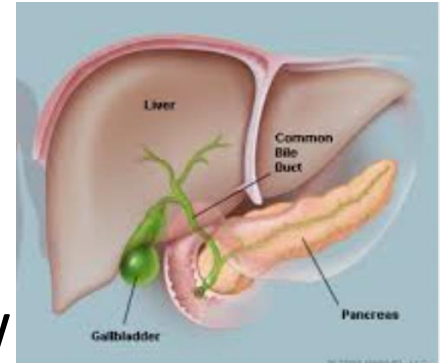
Tests for Liver injury

Tests for biliary injury and impaired bile flow

Tests for functions of the liver

Tests indirectly indicative of liver dysfunction-FBC

Tests for cause of these abnormal LFT

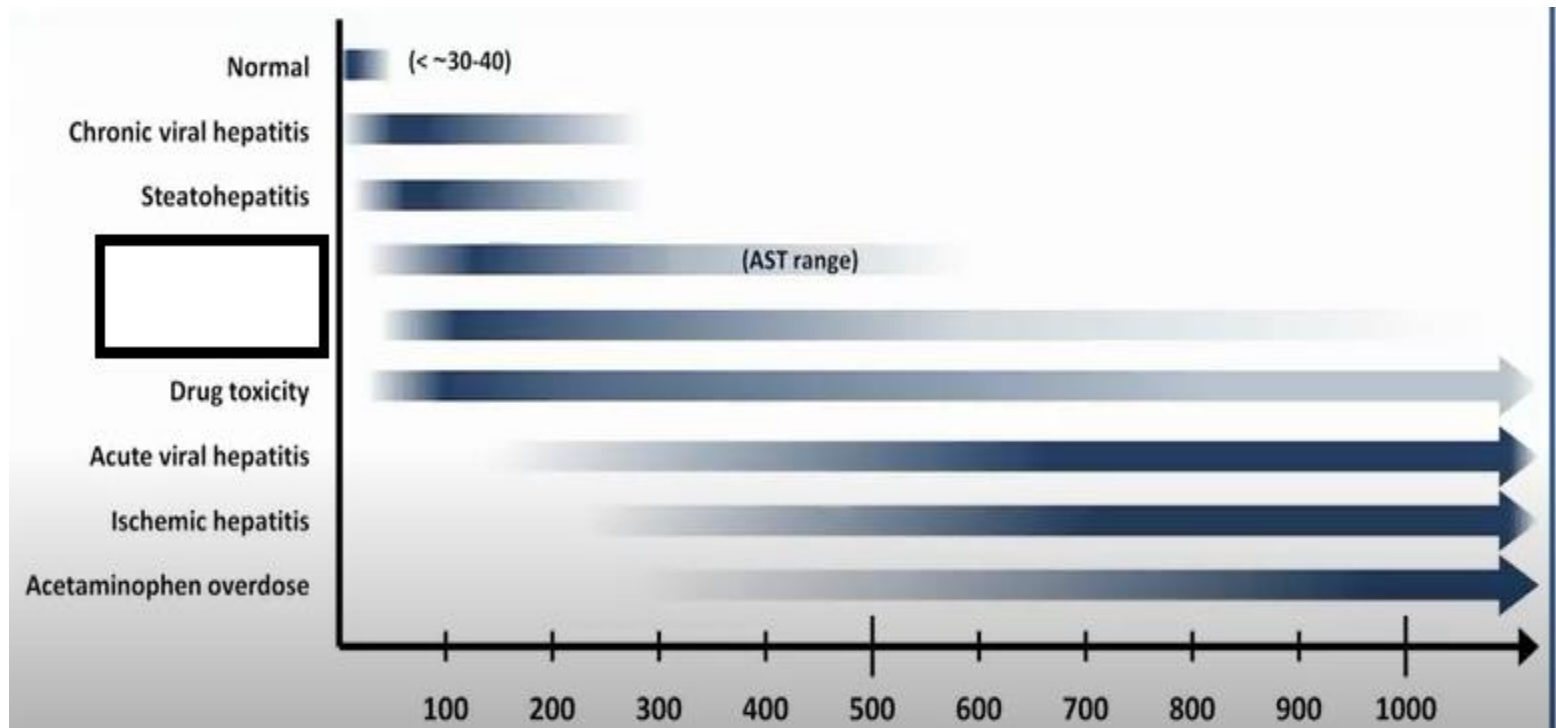


Blood tests

- Hepatic enzymes – AST,ALT,ALP,GGT
- Synthetic function- PT,ALB, Blood sugar
- Bilirubin- Total/unconjugated/conjugated
- Detoxifying : Ammonia, Lactate

Hepatic Enzymes

- AST- Liver, Muscle, RBC and Kidney
- ALT- Predominantly liver so more specific

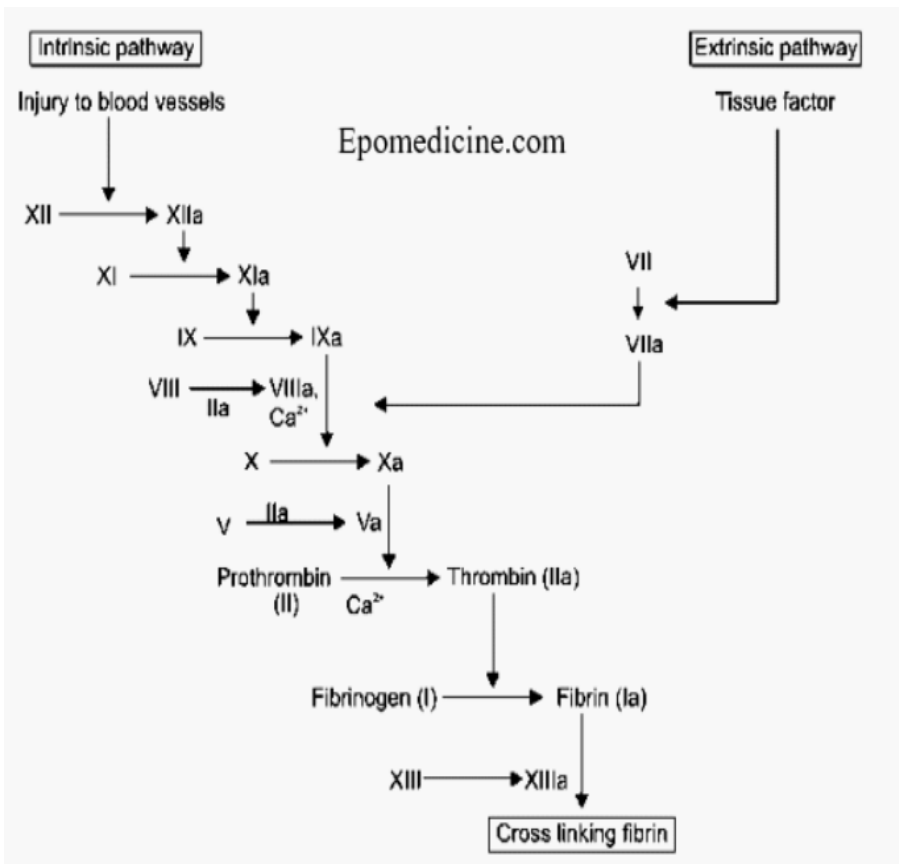


ALP and GGT (diagnostic rather than function)

- ALP- limited use in children
- GGT – biliary and hepatocellular

Synthetic functions

Prothrombin time

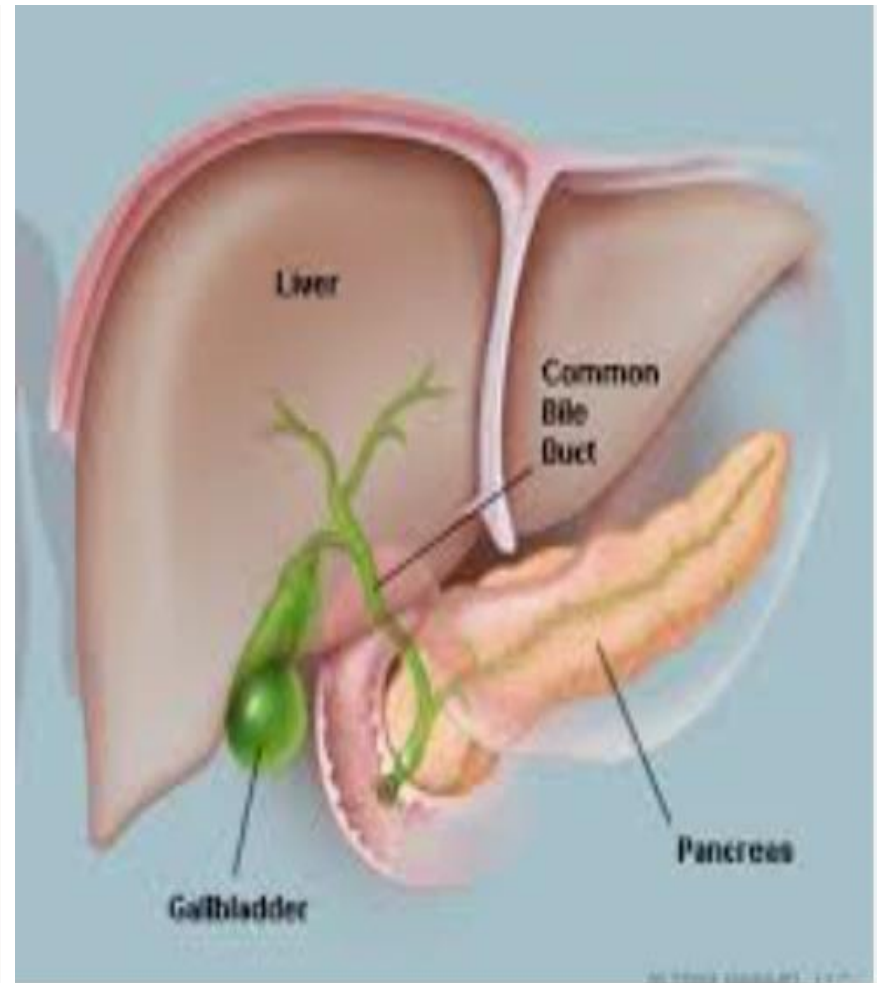
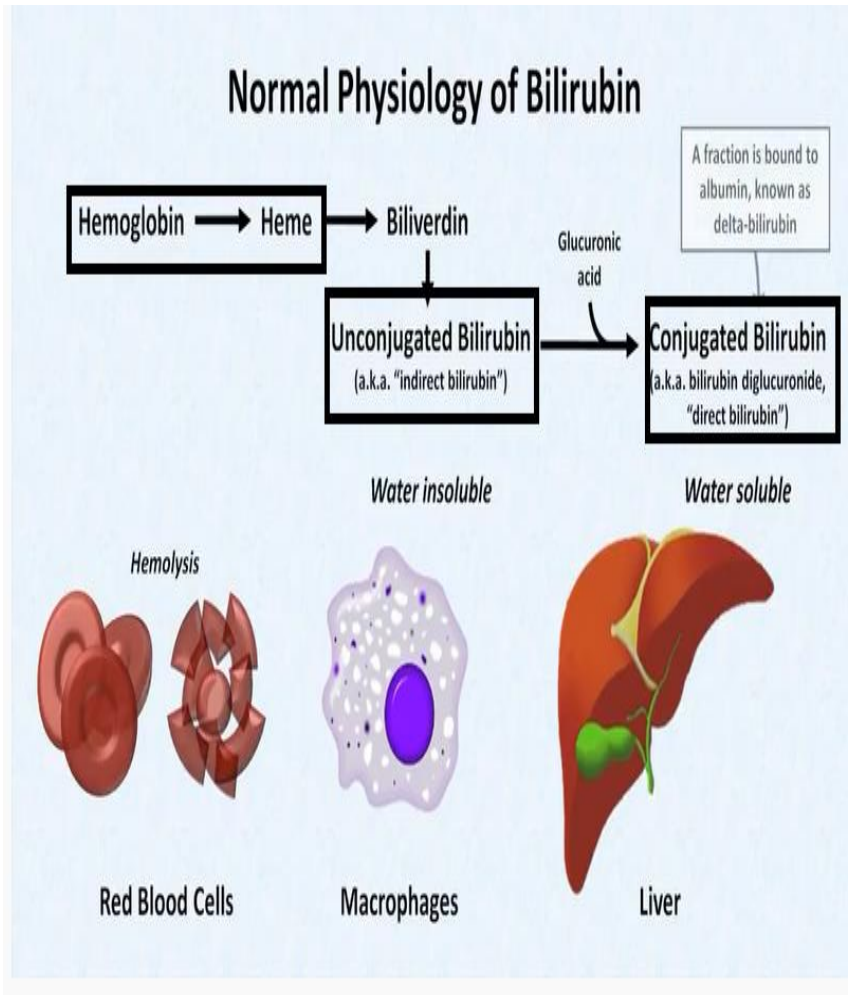


Albumin

- Synthesized by liver
- Long half life – 3 weeks
- Isolated low albumin: other causes

Gluconeogenesis- low BM

Jaundice-hyperbilirubinemia



High Total Bilirubin-request split fraction!

- Unconjugated Bilirubin
- Haemolysis
- Genetic conditions- Gilbert's, CNS
- Conjugated Bilirubin
- Biliary disease
- Hepatocellular disease
- Genetic syndromes

Common Patterns of LFT Abnormalities

	AST, ALT	Alk phos, GGT	Bilirubin	Albumin	INR
Hepatocellular	↑ to ↑↑↑	Normal to ↑↑	Normal to ↑↑	Normal to ↓↓	Normal to ↑↑
Cholestatic	Normal to ↑↑	↑ to ↑↑↑	↑ to ↑↑↑	Usually normal, unless chronic and severe	Usually normal, unless chronic and severe
Isolated Hyperbilirubinemia	Normal	Normal	↑ to ↑↑↑	Normal	Normal
Isolated Synthetic Dysfunction	Normal	Normal	Normal	↓ to ↓↓↓	↑ to ↑↑↑
Cirrhosis	Normal to ↑	Normal	↑ to ↑↑↑	↓ to ↓↓↓	↑ to ↑↑↑

Detoxifying function

- Ammonia : converted to urea in liver
- Lactate : cleared by liver

Other tests

Tests indirectly indicative of liver dysfunction

- Low platelets
- Low Vitamins
- Low Haemoglobin
- Renal dysfunction
- Electrolyte abnormalities

Tests to find the cause of liver dysfunction

- Depending on history/clinical examination

Radiology-USS and others

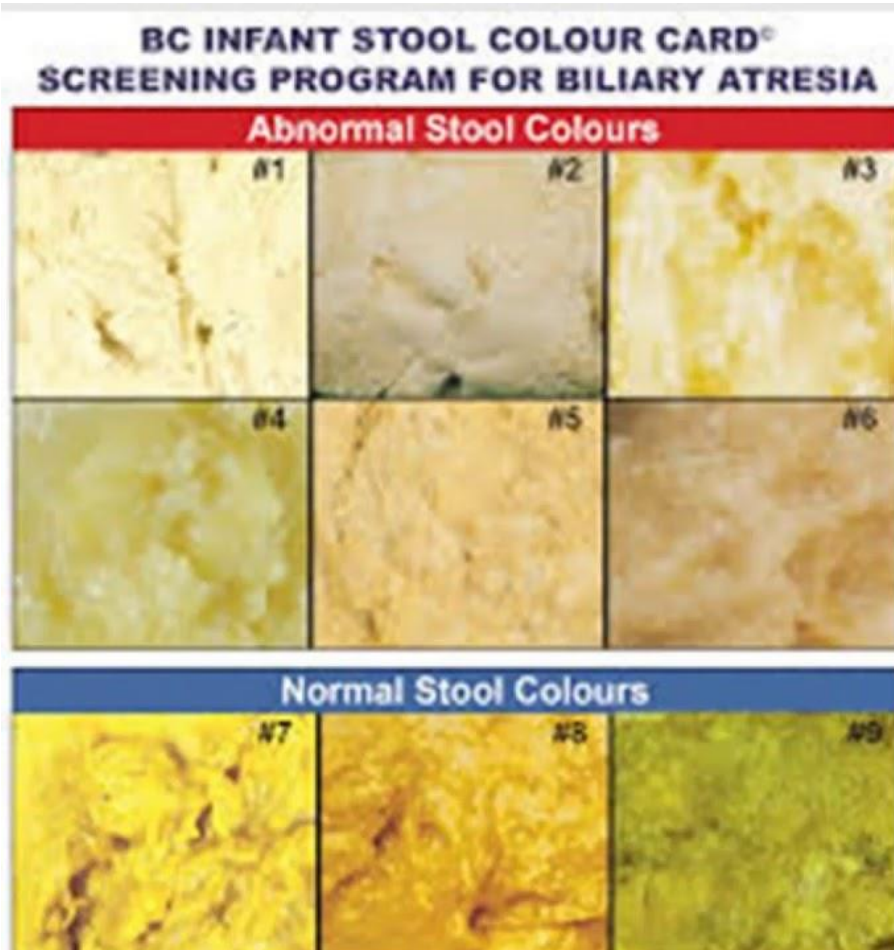
Case 1

7 day old baby not feeding well, weight loss, jaundiced

Nothing remarkable on examination

	Scenario 1	Scenario 2	Scenario 3	Scenario 4 Post Heart S x	Scenario 5
SBR	340/10	160/100	160/100	100/30	240/160
AST	40	140	4000	14000	40
ALT	40	140	2000	11100	40
PT	13	25----13	13	20----20	45---- 47
GGT	400	400	400	400	40
ALB	38	35	32	38	22

Neonatal pale stools



Biliary atresia presents as pale stools by 2 weeks and definitely before 4 weeks

Stool color chart has sensitivity of 76.9% ,specificity of 99.6%

It is the most common indication for Paediatric liver transplant

Kasai's procedure needs to be done as early as possible

Using SCC lead to earlier diagnosis, better prognosis and willingness to undergo kasai's procedure(ADC, Aug.2020,720-723

Neonatal Liver Failure –Common causes

- Galactosemia- Gal-1-Put –stop feeds, change to soy
- Infections –HSV, Enterovirus, always cover with aciclovir
- GALD-Immunoglobulins
- Other, 70% restricted fluids, antibiotics, antifungals, Vit K, liaise with hepatologist

Case 2

2 year old previously fit and well, fever and rash x 4 days

- HB 100
 - PLT 32
 - SBR 100/60
 - AST 3000,ALT 1500
 - GGT 120
 - Alb 38
 - PT 40
 - Lactate 4
 - NH4 160
 - BM 2
 - USS – starry sky appearance, GB thickening
- HB 100
 - PLT 32
 - SBR 100/60
 - AST 80,ALT 150
 - GGT 120
 - Alb 24
 - PT 25
 - Lactate 3
 - NH4 145
 - BM 4
 - USS – nodular liver with splenomegaly

Acute Hepatitis

- PCM level Hep A IgM
- Hep B S Ag Hep C Ab
- Hep E IgM EBV,CMV
- HHV6/7 PCR Adenovirus PCR
- HSV PCR Enterovirus

- SARS-coV-2
- **Ferritin**
- USS

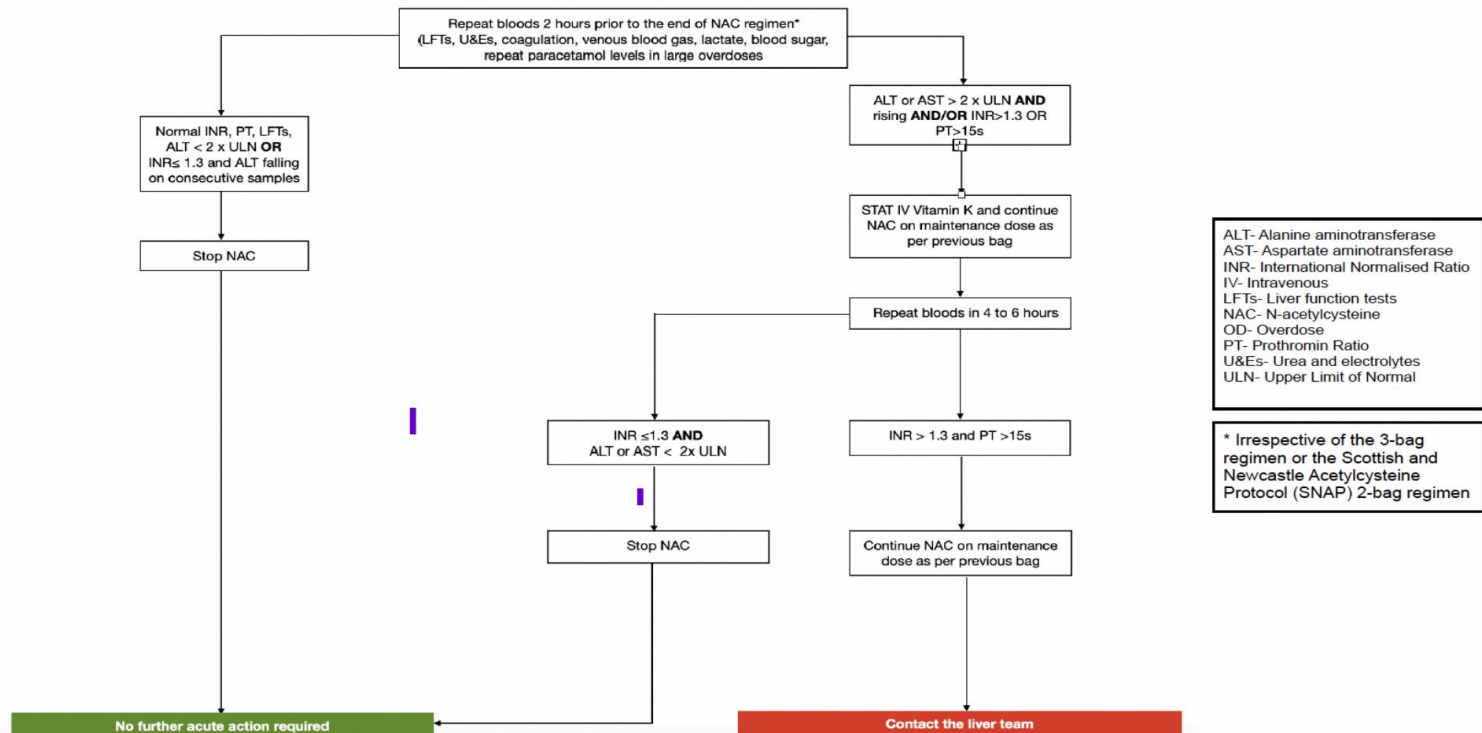
Management

- Supportive: FSV, URSO
- Monitor for ALF
- If ALF- 70% restricted fluids
- Antibiotic, antifungal
- NAC for PCM overdose
- IV Vit K od
- GCS monitoring-intubate if < 8
- Liaise with Liver centre at the earliest

POD Overdose- BSPGHAN Guideline: Kelgeri C et al.

<https://bspghan.org.uk/new-guideline-assessment-monitoring-and-management-of-deliberate-and-accidental-paracetamol-overdose-in-children>

Flowchart 1: Assessment and Management of Paracetamol Overdose after completion of initial NAC regimen



ALT- Alanine aminotransferase
 AST- Aspartate aminotransferase
 INR- International Normalised Ratio
 IV- Intravenous
 LFTs- Liver function tests
 NAC- N-acetylcysteine
 OD- Overdose
 PT- Prothrombin Ratio
 U&Es- Urea and electrolytes
 ULN- Upper Limit of Normal

* Irrespective of the 3-bag regimen or the Scottish and Newcastle Acetylcysteine Protocol (SNAP) 2-bag regimen

Indications to contact the Liver Unit

- Acute Liver Failure (ALF)- defined as:
 - Prothrombin time (PT) \geq 15 seconds or international normalised ratio (INR) \geq 1.5 not corrected by vitamin K in the presence of hepatic encephalopathy OR
 - PT \geq 20 or INR \geq 2.0 regardless of the presence or absence of clinical encephalopathy
- pH < 7.3
- Acute Kidney Injury- defined as: Serum creatinine > 1.5 times the previous baseline or reference creatinine or upper limit of normal for the age OR Urine output < 0.5 ml/kg/hour for 8 hours
- Encephalopathy
- Hypoglycaemia (< 3.3 mmol/L)
- Persistently high lactate (Lactate > 2)
- Patients with previous Liver Transplant
- Patients with chronic liver disease or other liver pathologies (known to the liver team)
- IV Paracetamol Overdose
- Paracetamol Overdose in Neonates

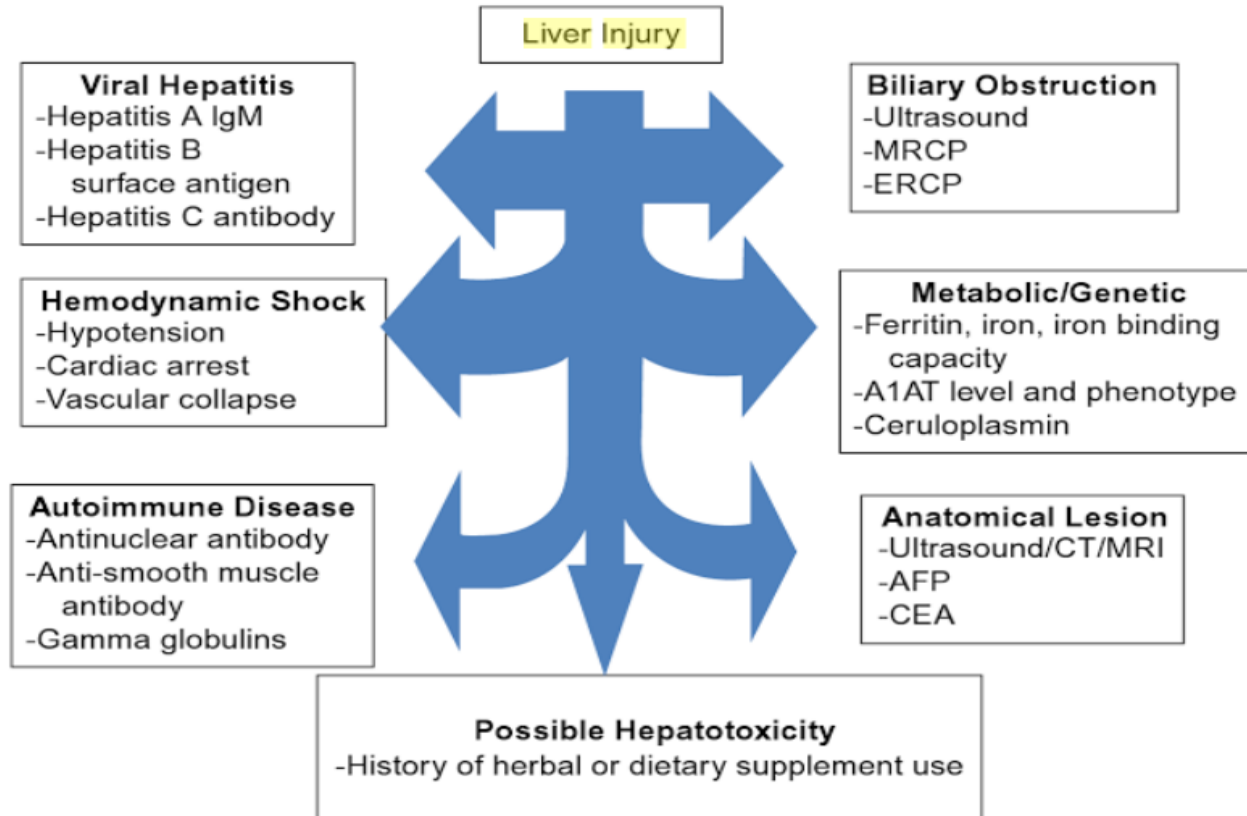
Case 3

- 10 year old in PICU, non liver related cause on PN for some time–
SBR 200/180, AST 85, ALT 80, GGT 500, Alb 36,
PT 14

What other investigation would you like?

Drug induced Liver disease (DILI)

Diagnosis of exclusion :Liver dysfunction screen



DILI –Management

Drug-induced liver injury in children

May 2024, Kelgeri et al.

[Archives of Disease in Childhood - Education and Practice](#)

- RECAM and RUCAM calculators



Chronic liver disease

- IgG
- AIP
- Ceruloplasmin
- A1AT

Case 4

- 10-year-old with gastroenteritis-
- SBR 60
- ALT 24
- AST 24
- GGT 30
- ALB 40
- INR 1

Case 5

- 4-year-old boy seen in OP for developmental delay-
- INR 1
- SBR 12
- **AST 500**
- **ALT 400**
- ALB 40
- GGT 30

- Thank you
- Questions ?