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4. PSA

Ward	Casualty Department	D.O.B/Age	04/12/1940
Consultant			

Prostate-specific Ag (PSA) **949.50 H**
ug/L <4.00

Urinary retention.

Request form: Lower urinary tract symptoms and urinary retention.

Important clinical findings to assess for include:

General: Temporal wasting, signs of urinary incontinence (e.g. any leaking noted, need to wear sanitary products)

Abdominal: Assess for masses, palpable bladder from retention

P.R: Assess prostate for size, consistency, tenderness.

CNS: Assess for any neurological fallout as prostatic metastasis tend to metastasize to the lower vertebrae.

Creatinine

83

umol/L	64 – 104		
eGFR (MDRD formula)		>60	
mL/min/1.73 m ²			
White Cell Count		5.01	x
10 ⁹ /L	3.92 – 10.40		
Red Cell Count		5.39	x
10 ¹² /L	4.50 – 5.50		
Haemoglobin		15.5	
g/dL	13.0 – 17.0		
Haematocrit		0.485	
L/L	0.400 – 0.500		
MCV		90.0	
fL	83.1 – 101.6		
MCH		28.8	
pg	27.8 – 34.8		
MCHC		32.0 L	
g/dL	33.0 – 35.0		
Red Cell Distribution Width		13.2	
%	12.1 – 16.3		
Platelet Count		226	x
10 ⁹ /L	171 – 388		

PATHOLOGICAL DIAGNOSIS:

Prostate, biopsy:

Adenocarcinoma.

Imaging studies may be necessary if there is a concern for metastasis and these will be guided by the clinical presentation e.g. CXR if metastasis to the lungs is suspected vs MRI if there is a concern of vertebral collapse.

Prostatic adenocarcinoma.

- Prostate-specific antigen (PSA) is a protein produced by normal prostatic cells. The majority of PSA is produced by the glands in the transitional zone of the prostate (BPH). The peripheral zone, where 80% of prostate cancers originate, produces very little PSA.

- An enlarged prostate can cause obstructive uropathy. The creatinine values in this patient do not suggest renal impairment though a baseline creatinine would be required to assess this.
- PSA is used for screening, diagnosis as well as monitoring of prostate related disease processes. PSA is an organ-specific, not a cancer-specific marker. It is useful in detection, staging and monitoring of prostate cancer.
- To improve diagnostic accuracy when PSA is between 4-10ug/L ("grey zone"), free PSA is measured and the free/total PSA ratio is calculated. Most normal PSA is protein-bound, and in prostatic cancer, a greater proportion is unbound. A free/total PSA ratio <0.25 increases the likelihood of cancer.

21. APT

Ward	Maternity Ward	D.O.B/Age	27 y.o
Consultant	Dr C. Hudson		

APT test positive.

?haemolytic disease of the newborn

27 y.o. female

G2P1 at 34 weeks

RH negative with Rhesus iso-immunization. Anti-D titres 1:128. (Blood group AB negative). Coombs test positive. Risk of haemolytic disease of the new-born.

Not applicable/difficult to examine foetus in-utero. Ultrasound of the middle cerebral artery peak systolic

velocity was suggestive that the baby was anaemic.

U/s guided chordocentesis done and foetal blood sample obtained in utero. FBC whilst in utero showed Hb: 9.8.

Clinician requested APT test to ensure that foetal sample obtained during chordocentesis.

Haematology did Kleihauer Betke Test and it showed 100% foetal haemoglobin. APT test also correlated and showed foetal haemoglobin.

Ultrasound: middle cerebral artery peak systolic velocity suggestive that the baby was anaemic. U/s guided chordocentesis done and foetal blood sample obtained in utero. FBC whilst in utero showed Hb: 9.8.

APT test confirmed that foetal blood had been obtained during chordocentesis. It also correlated with the Kleihauer Betke done by haematology.

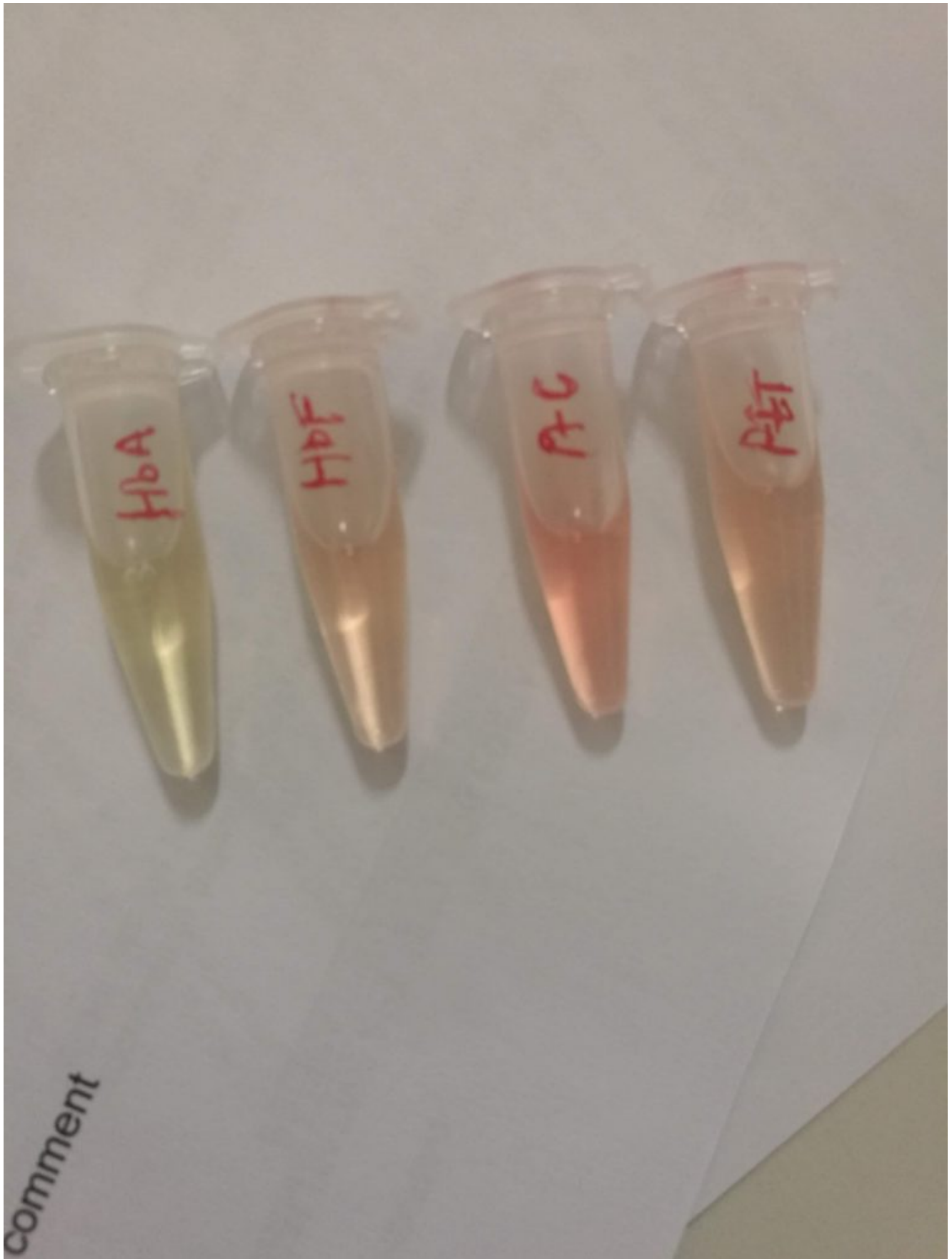


Image 1

HbA: adult haemoglobin; HbF: foetal haemoglobin; PtC: patient control; PtT: test control.

Note the slight green tinge of HbA

Principles of the APT test: Sodium hydroxide (NaOH) denatures adult oxyhaemoglobin to haematin (with a colour change from pink to yellow green). Foetal haemoglobin resists alkaline denaturation by NaOH and maintains a pink colour. If adult haemoglobin (HbA) is present in the sample, it turns yellow and then green within two minutes of the addition of sodium hydroxide. Any pink colour that persists for longer than 2 minutes indicates foetal haemoglobin (HbF) is present in the sample.

The Kleihauer Betke Test is an acid-elution assay performed on maternal blood to determine the amount of HbF that has passed into maternal circulation. The process exposes maternal blood smear to an acid solution. HbF, being resistant to the acid, remains intact, whereas HbA is removed. Following this, the smear is stained via Shepard's method. The foetal red blood cells are left rose-pink in colour, and the maternal cells appear "ghost-like" due to the absence of staining. This test is done by Haematology. Other ways of differentiating maternal from foetal blood is examining the MCV. The foetus has a larger MCV. This is nonspecific though as the mother may have macrocytic anaemia.

3. Hyperammonaemia

Ward	Medical ward	D.O.B/Age	16/07/1950
Consultant			

Ammonia

251 H

umol/L

[11 – 35]

Specimen request form has hepatic encephalopathy written as the diagnosis/reason for request.

Unable to obtain.

Unable to obtain.

Sodium	143	mmol/L	[136 – 145]
Potassium	4.4	mmol/L	[3.5 – 5.1]
Urea	28.1 H	mmol/L	[2.1 – 7.1]
Creatinine	359 H	umol/L	[64 – 104]
eGFR (MDRD formula)	15	mL/min/1.73 m2	
INR		2.77	
Total bilirubin	54 H	umol/L	[5 – 21]
Conjugated bilirubin (DBil)		36 H	umol/L
		[0 – 3]	
Alanine transaminase (ALT)		34	U/L
		[10 – 40]	
Aspartate transaminase (AST)		113 H	U/L [15 –
		40]	
Alkaline phosphatase (ALP)		105	U/L
		[53 – 128]	
Gamma-glutamyl transferase (GGT)		33	
	U/L	<68	

Unremarkable CMP. Elevated WCC of 11 otherwise normal FBC.
Further investigations not requested on Trakcare. ?patient
discharge vs transfer vs demise

?Fulminant liver cirrhosis

?End stage liver disease

Most ammonia dealt with by the liver is produced by gut organisms. Protein degradation forms a smaller contribution. Ammonia in high concentrations is neurotoxic. It is detoxified by the liver to urea via means of the urea cycle, and urea is subsequently excreted in the urine. Pre-analytical factors including a delay in sample reception and sample not transported on ice may cause raised ammonia results. Other pre-analytical factors to consider include:

- No smoking by the person collecting the sample or the

patient the sample is being collected from.

- Tourniquet should not be applied tightly or for too long (no tourniquet application ideal).
- Collected in an EDTA container.
- Must reach the lab within 15 to 20 minutes of being collected on ice.
- Patient should be fasted.

This patient has mildly deranged liver function tests and a prolonged INR suggesting liver disease which may be contributing to the hyperammonaemia. The unremarkable elevation in the liver enzymes may be due to a decrease of viable hepatocytes.

20. Alpha-foetoprotein

Ward	Emergency unit	D.O.B/Age	07/08/1968
Consultant	Dr C. Hudson		

Request form: No clinical information provided

Unavailable.

Unavailable.

Sodium			130	L
mmol/L	136 – 145			
Potassium			3.7	
mmol/L	3.5 – 5.1			
Urea			2.9	
mmol/L	2.1 – 7.1			
Creatinine			64	
umol/L	49 – 90			
eGFR (MDRD formula)		>60		mL/min/1.73

m2

Glycated haemoglobin (HbA1c):

Glycated haemoglobin (NGSP)	6.5	%
Glycated haemoglobin (IFCC)	48	
mmol/mol		
Estimated average glucose (eAG)	7.8	mmol/L
Calcium	2.20	
mmol/L	2.15 – 2.50	
Total protein	86	H
g/L	60 – 78	
Albumin	28	L
g/L	35 – 52	
Total bilirubin	26	H
umol/L	5 – 21	
Conjugated bilirubin (DBil)	25	H
umol/L	0 – 3	
Alanine transaminase (ALT)	65	H
U/L	7 – 35	
Aspartate transaminase (AST)	444	H
U/L	13 – 35	
Alkaline phosphatase (ALP)	568	H
U/L	42 – 98	
Gamma-glutamyl transferase (GGT)	662	H
U/L	<40	
Lipase	91	H
U/L	13 – 60	
Alpha-feto protein (AFP)	545010.0	H
ug/L	0.0 – 7.0	
Thyroid stimulating hormone	6.61	H
mIU/L	0.27 – 4.20	
Thyroxine (free T4)	13.7	
pmol/L	12.0 – 22.0	

White Cell Count		8.93	x
109/L	3.90 – 12.60		
Red Cell Count		2.92 L	x
1012/L	3.80 – 4.80		
Haemoglobin		9.4 L	
g/dL	12.0 – 15.0		
Haematocrit		0.278 L	
L/L	0.360 – 0.460		
MCV		95.2	
fL	78.9 – 98.5		
MCH		32.2	
pg	26.1 – 33.5		
MCHC		33.8	
g/dL	32.7 – 34.9		
Red Cell Distribution Width		19.5 H	
%	12.4 – 17.3		
Platelet Count		246	x
109/L	186 – 454		

Medical Validation : (Authorise By Episode)

Option Mode Inquire Function Audit Print Help Result

Episode No. [REDACTED] MRN [REDACTED] HPRN [REDACTED] Stat [REDACTED]

F 51 y 07/08/1968

Hos Groote Schuur Hospital wc GSH 021 404 9111 Collection 30/12/2019 13:04

Wrd C15 Emergency Unit 404 5208 / 09 Received 30/12/2019 13:18

Doc [REDACTED] Registered 30/12/2019 13:20 ePR Detail

Visit Test Set(s)

- [A] TREQ <M entry>
- [A] SPARE1 <A entry>
- [A] HBA1C <A entry>
- [A] CA <A entry>
- [A] LIPASE <A entry>
- [E] AFP # <M entry> (VQ:CR)
- [A] TSH <A entry>

(* Curr.) (# In List)

Update Authorise Amend Fully Authorise Clear Cancel

Staff Notes : C136

Help

[30/12/2019 22:34] [REDACTED] AFP Checked.

R1 - >1210
R2 - >60500 1:50
R3 - >121000 1:100
R4 - >484000 1:400
R5 - 545010 1:1000
[30/12/2019 22:42 bilqeess.jacobs] Result verified

OK Cancel

Test Set	Staff Notes	Test Item	Result	Units	Normal Values	Previous Result 1	Previous Result 2	Previous Result 3	Previous Result 4	Previous Result 5
ALB		Albumin	28	g/L	35 - 52					
TBIL		Total bilirubin	26	umol/L	5 - 21					
		Total bilirubin auto com								
CBIL		Conjugated bilirubin (Df	25	umol/L	0 - 3					
ALT		Alanine transaminase (A	65	U/L	7 - 35					
AST		Aspartate transaminase	444	U/L	13 - 35					
ALP		Alkaline phosphatase (A	568	U/L	42 - 98					
GGT		Gamma-glutamyl transfe	662	U/L	<40					
LIPASE		Lipase	91	U/L	13 - 60					
AFP	☒	Alpha-feto protein (AFP	545,010.0	ug/L	0.0 - 7.0					
		Machine (Serum)	COB							
		AFP auto comment	AFPCOB							
TSH		Thyroid stimulating hor	6.61	mIU/L	0.27 - 4.20					
FT4		Thyroxine (free T4)	13.7	pmol/L	12.0 - 22.0					
SIND		Serum haemoglobin inc	0							
		Serum bilirubin index	1							
		Serum lipaemia index	0							
		Serum haemoglobin va	0.00							

Abdominal ultrasound +/- CT scan may be helpful in detecting presence of liver mass +/- intra-abdominal masses.

Final diagnosis

?Hepatocellular carcinoma

This case allowed me to become familiar with the concepts related to limitations of an assay. Having come across the need for dilution and the concept of high-dose hook effect, I found it interesting to see the gradual increase in AFP value as further dilutions were done. These are terms and concepts that this case allowed me to become familiar with.

Limit of Blank: This is the highest apparent analyte concentration expected to be found when replicates of a blank sample (containing no analyte) are tested. Detects “noise” that could interfere with the result.

Limit of Detection: This refers to the lowest analyte concentration likely to be reliably distinguished from the limit of blank and at which detection is feasible. LoD is determined using measured limit of blank, and test replicates known to contain a low concentration of an analyte.

Limit of Quantitation: This is the lowest concentration at which the analyte can not only be reliably detected but also at which some predefined goals for precision and bias are met. The LoQ may be equivalent to the LoD or it could be at a higher concentration. This is the limit that is clinically significant.

2. Creatine Kinase

Ward	Pollsmoor Female Centre	D.O.B/Age	10/10/1988
Consultant			

Creatine kinase (CK)	265 070 H	U/L	20 – 180
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Request form: Unable to obtain on Equation document viewer.
Differential diagnosis in this patient includes
rhabdomyolysis, severe burns, myocardial injury or ischaemia.

History

Unavailable.

Unavailable.

Sodium	139
mmol/L	136 – 145

Potassium	3.8
mmol/L	3.5 – 5.1

Urea	2.6
mmol/L	2.1 – 7.1

Creatinine	63
umol/L	49 – 90
eGFR (MDRD formula)	>60
mL/min/1.73 m2	

Total protein	76
g/L	60 – 78

Albumin	46
g/L	35 – 52

Total bilirubin	6
umol/L	5 – 21

Conjugated bilirubin (DBil)	2
umol/L	0 – 3
Alanine transaminase (ALT)	317 H
U/L	7 – 35
Aspartate transaminase (AST)	1727 H
U/L	13 – 35
Alkaline phosphatase (ALP)	153 H
U/L	42 – 98
Gamma-glutamyl transferase (GGT)	43 H
U/L	<40

Folder unavailable. No treating doctor listed.

Final diagnosis

Rhabdomyolysis (most likely secondary to blunt force trauma).

Creatine kinase is an enzyme primarily found in muscle tissue that catalyzes the conversion of creatine and adenosine triphosphate (ATP) into phosphocreatine and adenosine diphosphate (ADP). This reaction is reversible and thus phosphocreatine serves as a rapidly available source of ATP. When muscle tissue is stressed or inflamed, the sarcoplasmic membrane becomes permeable and leaks cytosolic enzymes like creatine kinase into the bloodstream. The differential diagnosis of an elevated CK concentration is long and complex. Musculoskeletal trauma, myocardial injury, infections, and drug-induced myositis are the most common causes encountered in general clinical practice. Also worth noting in this patient is the AST is markedly elevated in comparison to the other liver enzymes. This, coupled with the elevated CK levels imply that quite significant muscle damage has occurred.

Making dilutions when results are appearing as having a greater than value on the analyzer is important. Creatine

kinase is an enzyme that may be used to monitor the clinical condition of a patient. It may thus be useful to know exact values to be able to determine ongoing damage vs resolution. By preparing samples in dilution, this allows for a relatively accurate determination of the concentration of an analyte of interest by overcoming large reagent requirements.