

## Impaired Gallbladder Function -Part Two

All right, let's look at some cases. This patient is a 34-year-old male with chief complaint of fatigue, bloating, constipation, and brain fog.

TESTS	RESULT	FLAG	UNITS	REFERENCE INTERVAL
CMP14+LP+TP+TSH+5AC+TIBC+C	B			
Chemistries				
Glucose, Serum	83		mg/dL	65 - 99
Hemoglobin Alc	5.0		8	4.8 - 5.6
Increa	ased risk for d	liabetes:		5.7 - 6.4
Diabet	tes:			>6.4
Glycer	nic control for	adults	with diabete	es: <7.0
Uric Acid, Serum	6.4		mg/dL	3.7 - 8.6
Please Note:				
	Therapeut	ic targe	t for gout p	patients: <6.0
BUN	23	High	mg/dL	6 - 20
Creatinine, Serum	1.10		mg/dL	0.76 - 1.27
eGFR If NonAfricn Am	90		mL/min/1.73	>59
eGFR If Africn Am	104		mL/min/1.73	>59
Note: A persistent ed	GFR <60 mL/min/	1.73 m2	(3 months of	r more) may
indicate chronic kids	ney disease. An	eGFR >5	9 mL/min/1.7	73 m2 with an
elevated urine protes	in also may ind	licate ch	ronic kidney	y disease.
Calculated using CKD-	-EPI formula.			
Sodium, Serum	141		mmol/L	135 - 145
Potassium, Serum	4.5		mmol/L	3.5 - 5.2
Chloride, Serum	100		mmol/L	97 - 108
Carbon Dioxide, Total	24		mmol/L	20 - 32
Calcium, Serum	10.2		mg/dL	8.7 - 10.2
Phosphorus, Serum	4.5		mg/dL	2.5 - 4.5
Magnesium, Serum	2.2		mg/dL	1.6 - 2.6
Protein, Total, Serum	7.2		g/dL	6.0 - 8.5
Albumin, Serum	4.9		g/dL	3.5 - 5.5
Globulin, Total	2.3		g/dL	1.5 - 4.5
A/G Ratio	2.1		-	1.1 - 2.5
Bilirubin, Total	1.6	High	mg/dL	0.0 - 1.2
Alkaline Phosphatase, S	87		IU/L	25 - 150
LDH	146		IU/L	0 - 225
	25		TU/L	0 - 40
AST (SGOT)				
AST (SGOT) ALT (SGPT)	38		IU/L	0 - 55



TESTS	RESULT	FLAG	UNITS	REFERENCE INTERVAL
Fe+TIBC+Fer				
Iron Bind.Cap.(TIBC)	248	LOW	ug/dL	250 - 450
UIBC	129	LOW	ug/dL	150 - 375
Iron, Serum	119		ug/dL	40 - 155
Iron Saturation	48		8	15 - 55
Ferritin, Serum	321		ng/mL	30 - 400
Bilirubin, Total/Direct, Seru	m			
Bilirubin, Total	1.4	High	mg/dL	0.0 - 1.2
Bilirubin, Direct	0.30		mg/dL	0.00 - 0.40
Bilirubin, Indirect	1.10	High	mg/dL	0.10 - 0.80
Thyroid Antibodies				
Thyroid Peroxidase (TPO) Ab	19		IU/mL	0 - 34
Antithyroglobulin Ab	<20		IU/mL	0 - 40
Siemens (DPC) ICMA Metho	odology			
Thyroxine (T4) Free, Direct,	S			
T4, Free(Direct)	1.44		ng/dL	0.82 - 1.77
Cystatin C	0.55		mg/L	0.53 - 0.95
Triiodothyronine, Free, Serum	2.4		pg/mL	2.0 - 4.4

The total bilirubin here is 1.6, and LDH, ALT, AST, and GGT are normal. He didn't have any risk factors for liver or gallbladder disease. No medications. No jaundice.

You would definitely suspect Gilbert's disease in this case, and we ran a total and direct bilirubin as a follow-up test. As you can see, again, the total was high at 1.4, and most of it was indirect or unconjugated, 1.10. This is consistent with Gilbert's disease.



Marker	Value	Functional Range	Lab Range
Glucose	96	75 - 85	65 - 99
Hemoglobin Alc	5.7	4.4 - 5.4	4.8 - 5.6
Uric Acid	5.7	M: 3.7 - 6.0	3.7 - 8.6
BUN	17	13 - 18	6 - 24
Creatinine	0.71	0.85 - 1.1	0.76 - 1.27
Sodium	142	135 - 140	134 - 144
Potassium	3.5	4.0 - 4.5	3.5 - 5.2
Chloride	102	100 - 106	97 - 108
C02	25	25 - 30	18 - 29
Calcium	9.5	9.2 - 10.1	8.7 - 10.2
Phosphorus	3.2	3.5 - 4.0	2.5 - 4.5
Magnesium	2.1	2.0 - 2.5	1.6 - 2.6
Protein, total	7.0	6.9 - 7.4	6.0 - 8.5
Albumin	4.8	4.0 - 5.0	3.5 - 5.5
Globulin	2.2	2.4 - 2.8	1.5 - 4.5
A/G ratio	2.2	1.5 - 2.0	1.1 - 2.5
Bilirubin, total	1.3	0.1 - 1.2	0.0 - 1.2
Alkaline Phosphatase	93	42 - 107	39 - 117
LDH	127	140 - 180	0 - 225
AST	16	M: 10-30	0 - 40
ALT	19	M: 10-29	0-44
GGT	23	10 - 26	0 -65
TIBC	352	250 - 350	250 - 450
UIBC	148	150 - 375	150 - 375
Iron	204	85 - 135	40 - 155
Iron saturation	58	15 - 40	15 - 55
Ferritin	124	M: 33-100	30 - 400
Cholesterol, total	190	150 - 250	100 - 199
Triglycerides	106	50 - 100	0-149
HDL	65	55 - 85	> 39
LDL	104	0 - 175	0 - 99
Triglycerides / HDL Ratio	1.630	< 2	< 3.8
TSH	1.710	0.5 - 2.5	0.450 - 4.50
T4, total	6.9	6.0 - 12	4.5-12.0
T3 Uptake	29	M: 30-38	24 - 39
T3, Total	128	100 - 180	71 - 180
Vitamin D, 25-hydroxy	32.2	35 - 60	30.0 - 100.0
WBC	6.2	5.0 - 8.0	3.4 - 10.8
RBC	4.55	4.4 - 4.9	4.14 - 5.80
Hemoglobin	14.5	M: 14-15	12.6 - 17.7



43.8 96 31.9	M: 40-48	37.5 - 51.0
96 31.9	85 - 92	
31.9	0.0 0.0	79 - 97
	27.7 - 32.0	26.6 - 33.0
33.1	32 - 35	31.5 - 35.7
13.8	11.5 - 15.0	12.3 - 15.4
243	150 - 415	150 - 379
67	40 - 60	
29	25 - 40	
3	4.0 - 7.0	
1	0.0 - 3.0	
0	0.0 - 3.0	
471	450 - 2000	211 - 946
1.07		0.00 - 3.00
8.6		0.00 - 15.0
		0-32
		2.0-4.4
		0.82 - 1.77
	13.8 243 67 29 3 1 0 471 1.07 8.6	13.8   11.5 - 15.0     243   150 - 415     67   40 - 60     29   25 - 40     3   4.0 - 7.0     1   0.0 - 3.0     0   0.0 - 3.0     471   450 - 2000     1.07   8.6

The next patient is a 52-year-old male with the primary complaint of hypertension, consistently 140 or 150/90 despite diet and lifestyle modification. Total bilirubin was 1.3. ALT, AST, alkaline phosphatase, and GGT were normal. LDH was slightly low. No liver or gallbladder risk factors or medications.

The patient does have iron overload, but ferritin was 124, and ALT and AST were normal, so liver damage was an unlikely cause of elevated bilirubin in this case.

TESTS	RESULT	FLAG	UNITS	REFERENCE INTERVAL
Fe+TIBC+Fer				
Iron Bind.Cap.(TIBC)	331		ug/dL	250 - 450
UIBC	204		ug/dL	150 - 375
Iron, Serum	127		ug/dL	40 - 155
Iron Saturation	38		90	15 - 55
Ferritin, Serum	162		ng/mL	30 - 400
Fructosamine Published reference in between age 20 and 60 controlled diabetic po mean of 396 umol/L.	227 Aterval for a is 205 - 285 Opulation is	pparently umol/L a 228 - 563	umol/L healthy sub nd in a poor umol/L with	0 - 285 jects ly a
Bilirubin, Total	0.9		mg/dL	0.0 - 1.2
Bilirubin, Direct	0.23		mg/dL	0.00 - 0.40



Follow-up tests actually showed a normal total bilirubin, and the majority of it was indirect. His total was 0.9, and his direct was 0.23, so the remaining roughly 0.67 would have been indirect. Note that his iron levels were normal on the retest as well, so this illustrates the importance of retesting in both cases, since both the bilirubin and the iron were high on the initial test. Gilbert's disease is the probable cause of bilirubin elevation on the first test. Levels tend to fluctuate over time, and they won't always be elevated.

The next marker to consider is alkaline phosphatase, and we talked about this in the liver presentation, but we're going to look at it more specifically in the context of gallbladder disease. One study found that elevated alkaline phosphatase was due to a problem with the liver and gallbladder in 80 percent of patients and bone in only 18 percent of patients, so it is much more likely to be caused by liver and gallbladder issues.



I've put an algorithm for working up elevated alkaline phosphatase on this slide. If it is high, you do a history and physical exam, and you're looking for risk factors of liver and gallbladder disease as well as signs such as jaundice. Then, you would check other markers, especially GGT and 5'-nucleotidase. Both can confirm that elevated alkaline phosphatase is due to liver and gallbladder disease rather than bone. At that point, you could refer out for ultrasound or MRI of gallbladder or pancreas, or you can address the underlying issues and retest.



If alkaline phosphatase is still elevated, you would screen for viral hepatitis, primary biliary cirrhosis —you could run the antimitochondrial antibody, for example—primary sclerosing cholangitis through an MRI, or drug-related causes. If all of those are inconclusive, I would consider referral for further testing, possibly liver biopsy. Note that when the values of alkaline phosphatase are markedly elevated, such as more than four times the upper end of the range, it is more likely to be due to obstructive pathology such as bile duct stones, an infection, or cirrhosis.

Fasting Glucose	5.2	mmol/L	(3.6-6.0)
Sodium	138	mmol/L	(135-145)
Potassium	4.1	mmol/L	(3.5-5.5)
Chloride	99	mmol/L	(95-110)
Bicarbonate	27	mmol/L	(20-32)
Urea	7.1 H	mmol/L	(2.5-7.0)
Creatinine	99 H	umol/L	(45-85)
eGFR(CKD.EPI)	58 L		(>89)
Calcium	2.48	mmol/L	(2.15-2.55)
Ca (corr)	2.62 H	mmol/L	(2.15-2.55)
Phosphate	1.19	mmol/L	(0.8-1.5)
Magnesium	0.76	mmol/L	(0.70-1.05)
Total Protein	74	g/L	(64-81)
Albumin	33	g/L	(33-46)
Globulin	41	g/L	(26-41)
Alk Phos	165 H	U/L	(20-105)
Gamma GT	113 H	U/L	(5-35)
ALT	26	U/L	(5-30)
AST	30	U/L	(10-35)
LDH	138	U/L	(120-250)
Bilirubin	8	umol/L	(3-15)
Comments:			
Renal Function			in the same water
The eGFR is in the rand	ne 30-59 mL/min	n/1.73m2 w	which suggests moderate
chronic kidney disease	3 monthly mon	itoring of e	GFR is recommended
(*Kidney Health Austral	ia)		

This patient is a 51-year-old female with chief complaint of hot flashes and eczema. Her alkaline phosphatase was elevated at 165. Upper end of the range is 105. Her GGT was also high at 113, which is quite elevated, and then her AST and ALT were out of the functional range. This would confirm a liver-gallbladder source for the elevation of alkaline phosphatase.



Also, her creatinine is high, and her eGFR is low. Although I didn't mention it in the diagnostic algorithm on the last slide, a few studies have found that alkaline phosphatase is elevated in chronic kidney disease, and the degree of elevation has prognostic value in predicting the progression.

I referred this patient out, and she was eventually diagnosed with chronic kidney disease. In her case, it was not related to diabetes or hypertension. You can see her fasting glucose was normal. It was an inherited polycystic kidney disease, and that is why it had gone undiagnosed because she didn't have symptoms, and it didn't appear on routine blood work. She had only had a more comprehensive workup recently.

Tests	Result	Flag	Units	Reference Interval
CMP14+LP+4AC+CBC/D/Plt				
Glucose, Serum	151	High	mg/dL	65-99
Uric Acid, Serum	7.2	High	mg/dL	2.5-7.1
BUN	13		mg/dL	6-24
Creatinine, Serum	0.84		mg/dL	0.57-1.00
eGFR If NonAfricn Am	85		mL/min/1.73	>59
eGFR If Africn Am	98		mL/min/1.73	>59
BUN/Creatinine Ratio	15			9-23
Sodium, Serum	132	Low	mmol/L	134-144
Potassium, Serum	3.8		mmol/L	3.5-5.2
Chloride, Serum	98		mmol/L	97-108
Carbon Dioxide, Total	18	Low	mmol/L	19-28
Calcium, Serum	9.3		mg/dL	8.7-10.2
Phosphorus, Serum	3.6		mg/dL	2.5-4.5
Protein, Total, Serum	7.0		g/dL	6.0-8.5
Albumin, Serum	4.4		g/dL	3.5-5.5
Globulin, Total	2.6		g/dL	1.5-4.5
A/G Ratio	1.7			1.1-2.5
Bilirubin, Total	0.3		mg/dL	0.0-1.2
Alkaline Phosphatase, S	108	High	IU/L	42-107
LDH	142		IU/L	0-214



OMP14+LP+4AC+CBC/D/PH       AST (SGOT)     16     IU/L     0.40       ALT (SGPT)     19     IU/L     0.32       Iron, Serum     88     ug/dL     35-155       Cholesterol, Total     221     High     mg/dL     0-149       Tridysperides     134     mg/dL     0-149       HDL Cholesterol     55     mg/dL     >39       According to ATP-III Guidelines, HDL-C >59 mg/dL is considered a negative risk factor for CRD.     NUDL Cholesterol Cal     27     mg/dL     6-40       UDL Cholesterol Cal     27     mg/dL     0-99     Commert:     7. Chol/HDL Ratio     0.0     ratio units     0.0-4.4       Estimated CHD Risk     0.9     times avg.     0.0-1.0     12 Avg.Risk 5.0     4.       Yang.Risk 2.3.4     1.     Navg.Risk 5.0     4.     2X Avg.Risk 5.0     4.       VEC     6.0     x10E3/uL     3.410.8     Xvg.Risk 5.0     4.       VBC     6.0     x10E3/uL     3.410.8     XVg.Risk 5.0     4.       PEC     4.88     x10E3/uL     <
AST (SGOT)     16     IU/L     0-40       ALT (SGFT)     19     IU/L     0-32       Iron, Serum     88     ug/dL     35-155       Cholesterol, Total     221     High     mg/dL     00-199       Triglycerides     134     mg/dL     0-149       HDL Cholesterol     55     mg/dL     >39       According to ATP-III Guidelines, HDL-C >59 mg/dL is considered a negative risk factor for CHD.     NULD Cholesterol Cal     27     mg/dL     5-40       UDL Cholesterol Cal     27     mg/dL     0.0-4.4     Estimated CHD Risk     0.0     9     0.0-4.4       Estimated CHD Risk     0.9     times avg.     0.0-1.0     T. Chol/HDL Ratio     1/2 Avg.Risk 3.4     3.       Avg.Risk 5.0     4.     3     Avg.Risk 3.4     3.       Avg.Risk 5.0     4.     1/2 Avg.Risk 3.4     3.     Avg.Risk 3.6     7.       VERC     6.0     x10E3/uL     3.410.8     **Please note reference interval change**       REC     4.88     x10E3/uL     3.410.8     **Please note reference interval change**
ALT (SGPT)     19     IU/L     0-32       Iron, Serum     88     ug/dL     35-155       Cholesterol, Total     221     High     mg/dL     100-199       Triglycerides     134     mg/dL     0-149       HDL Cholesterol     55     mg/dL     >39       According to ATP-III Guidelines, HDL-C>59 mg/dL is considered a negative risk factor for CHD.       VLDL Cholesterol Calc     139     High     mg/dL     0-99       Comment:     .     .     .     .     .       T. Chol/HDL Patio     4.0     ratio units     0.0-4.4     .     .       Estimated CHD Risk     0.9     times avg.     0.0-1.0     .
Iron, Serum88ug/dL35-155Cholesterol, Total221Highmg/dL100-199Triglycerides134mg/dL0-149HDL Cholesterol55mg/dL>39According to ATP-III Guidelines, HDL-C >59 mg/dL is considered a negative risk factor for CHD.VLDL Cholesterol Cal27mg/dL5-40Comment: T. Chol/HDL RatioT. Chol/HDL Ratio4.0ratio units0.0-4.4Estimated CHD Risk0.9times avg.0.0-1.0T. Chol/HDL RatioMem Wome 1/2 Avg.Risk 3.43.Avg.Risk 9.67.XX Avg.Risk 9.6The CHD Risk is based on the T. Chol/HDL ratio. Othe factors affect CHD Risk us hased on the T. Chol/HDL ratio. Othe mature CHD.WEC6.0x10E3/uL3.4+10.8**Please note reference interval change**REC4.88x10E5/uL3.77-52.8Hemoglobin13.5g/dL11.1-15.9Hematorit43.0%34.0-46.6MCH27.7pg26.6-33.0MCHC31.4Lowg/dL31.5-35.7PDW13.5%12.5-15.4Batelets320v10E3/uL31.5-35.7Batelets320v10E3/uL31.5-35.7
Cholesterol, Total     221     High mg/dL     100-199       Triglycerides     134     mg/dL     0-149       HDL Cholesterol     55     mg/dL     >39       According to ATP-III Guidelines, BDL-C >59 mg/dL is considered a negative risk factor for CHD.     S40     540       VLDL Cholesterol Cal     27     mg/dL     0-99       Comment:     139     High mg/dL     0-99       Comment:     7.     Chol/HDL Ratio     0.0       T. Chol/HDL Ratio     4.0     ratio units     0.0-4.4       Estimated CHD Risk     0.9     T. Chol/HDL Ratio     Men Wome       1/2 Arg.Risk 3.4     3.4     3.     Avg.Risk 5.0     4.       2X Avg.Risk 9.6     7.     3X Avg.Risk 3.4     3.     Avg.Risk 3.4     3.       WEC     6.0     x10E3/uL     3.4+10.8     The CHD Risk is based on the T. Chol/HDL ratio. Othe factors affect CHD Risk such as hypertension, smoking diabetes, severe obesity, and family history of pre-mature CHD.       WEC     6.0     x10E3/uL     3.4+10.8       **Please note reference interval change**     FBEC     4.88     11.1+15.9  <
Triglycerides134mg/dL0-149HDL Cholesterol55mg/dL>39According to ATP-III Guidelines, HDL-C >59 mg/dL is considered a negative risk factor for CHD.>39VLDL Cholesterol Calc27mg/dL5-40LDL Cholesterol Calc139Highmg/dL0-99Comment:7ratio units0.0-4.4T. Chol/HDL Ratio4.0ratio units0.0-4.4Estimated CHD Risk0.9times avg.0.01.0Men Wome1/2 Avg.Risk 3.43.Avg.Risk 5.04.0ratio units2X Avg.Risk 5.0VBC6.0x10E3VuL3X Avg.Risk 2.3.411.WBC6.0x10E3VuL3.4-10.8FEC4.88x10E6VuL3.7-5.28Hemoglobin13.5g/dL11.1-15.9Hematorit43.0%34.0-46.6MCV881L79-97MCH27.7pg26.6-33.0MCHC31.4Lowg/dL31.5-35.7PDW13.5%12.3-15.4Batelets320x10E7/uL155.370
HDL Cholesterol55mg/dL>39According to ATP-III Guidelines, HDL-C >59 mg/dL is considered a negative risk factor for CHD.Somidational considered a negative risk factor for CHD.VLDL Cholesterol Cal27mg/dL5-40LDL Cholesterol Calc139Highmg/dL0-99Comment:139Highmg/dL0-99Comment:0.010ratio units0.0-4.4Estimated CHD Risk0.9times avg.0.01.0T. Chol/HDL Ratio0.9times avg.0.01.0T. Chol/HDL Ratio0.9times avg.0.01.0T. Chol/HDL Ratio0.9times avg.0.01.0T. Chol/HDL Ratio12 Avg.Risk 3.43.Avg.Risk 5.04.3.Avg.Risk 5.04.2.X Avg.Risk 5.0VBC6.0x10E3vL3.4vg.Risk 9.6WBC6.0x10E3vL3.4-10.8FBC4.88x10E6vL3.4-10.8Hemoglobin13.5g/dL11.1-15.9Hematocrit43.0%34.0-46.6MCV881L79-97MCH27.7pg26.6-33.0MCHC31.4Lowg/dL31.5-35.7PDW13.5%12.3-15.4Batelets320x10E7vil155.37
According to ATP-III Guidelines, HDL-C >59 mg/dL is considered a negative risk factor or CHD.VLDL Cholesterol Calc27mg/dL5-40LDL Cholesterol Calc139Highmg/dL0-99Comment:
VLDL Cholesterol Calc27mg/dL5-40LDL Cholesterol Calc139Highmg/dL0-99Comment:
LDL Cholesterol Calc139Highmg/dL0-99Comment:
Comment: T. Chol/HDL Ratio 4.0 ratio units 0.0-4.4 Estimated CHD Risk 0.9 times avg. 0.0-1.0 T. Chol/HDL Ratio Men Wome 1/2 Avg.Risk 3.4 3. Avg.Risk 3.4 3. Avg.Risk 3.4 3. Avg.Risk 5.0 4. 2X Avg.Risk 5.0 4. 2X Avg.Risk 5.0 4. 2X Avg.Risk 23.4 11. The CHD Risk is based on the T. Chol/HDL ratio. Othe factors affect CHD Risk such as hypertension, smoking diabetes, severe obesity, and family history of pre- mature CHD. WBC 6.0 x10E3/uL 3.4-10.8 **Please note reference interval change** RBC 4.88 x10E6/uL 3.77-52.8 Hemoglobin 13.5 g/dL 11.1-15.9 Hematocrit 43.0 % 34.0-46.6 MCV 88 fL 79-97 MCH 27.7 pg 26.6-33.0 MCHC 31.4 Low g/dL 31.5-35.7 PDW 13.5 % 12.3-15.4 Patelets
T. Chol/HDL Platio   4.0   ratio units   0.0-4.4     Estimated CHD Risk   0.9   times avg.   0.0-1.0     T. Chol/HDL Ratio   Men Wome   1/2 Avg.Risk 3.4   3.     Avg.Risk 5.0   4.   2X Avg.Risk 5.0   4.     2X Avg.Risk 9.6   7.   3X Avg.Risk 23.4   11.     The CHD Risk is based on the T. Chol/HDL ratio. Othe factors affect CHD Risk such as hypertension, smoking diabetes, severe obesity, and family history of premature CHD.     WBC   6.0   x10E3/uL   3.4-10.8     ***Please note reference interval change**     RBC   4.88   x10E6/uL   3.77-5.28     Hemoglobin   13.5   g/dL   11.1-15.9     Hematocrit   43.0   %   34.0-46.6     MCV   88   1L   79-97     MCH   27.7   pg   26.6-33.0     MCHC   31.4   Low   g/dL   31.5-35.7     RDW   13.5   %   12.3-15.4     Batelets   320   x10E3/ul   15-370
Estimated CHD Fisk 0.9 times avg. 0.0-1.0 T. Chol/HDL Ratio Men Wome 1/2 Avg.Risk 3.4 3. Avg.Risk 5.0 4. 2x Avg.Risk 9.6 7. 3x Avg.Risk 23.4 11. The CHD Risk is based on the T. Chol/HDL ratio. Othe factors affect CHD Risk such as hypertension, smoking diabetes, severe obesity, and family history of pre- mature CHD. WBC 6.0 x10E3/uL 3.4-10.8 **Please note reference interval change** RBC 4.88 x10E6/uL 3.77-5.28 Hemoglobin 13.5 g/dL 11.1-15.9 Hematocrit 43.0 % 34.0-46.6 MCV 88 fL 79-97 MCH 27.7 pg 26.6-33.0 MCHC 31.4 Low g/dL 31.5-35.7 FDW 13.5 % 12.3-15.4 Patelets 320 x10E3/ul 155.370
T. Chol/HDL Ratio Men Wome1/2 Avg.Risk 3.43.Avg.Risk 5.04.2X Avg.Risk 9.67.3X Avg.Risk 23.411.The CHD Risk is based on the T. Chol/HDL ratio. Othe factors affect CHD Risk such as hypertension, smoking diabetes, severe obesity, and family history of pre- mature CHD.WBC6.0x10E3/uL3.4-10.8**Please note reference interval change**RBC4.88x10E5/uLHemoglobin13.5Hematocrit43.0MCV681L7.7pg26.6-33.0MCHC31.4Lowg/dL31.5-35.7RDW13.5820x10E5/uL10E3/uL12.3-15.4
Men Wome1/2 Avg.Risk 3.43.Avg.Risk 3.43.Avg.Risk 3.67.2X Avg.Risk 9.67.3X Avg.Risk 23.411.The CHD Risk is based on the T. Chol/HDL ratio. Othefactors affect CHD Risk such as hypertension, smokingdiabetes, severe obesity, and family history of pre-mature CHD.WBC6.0x10E3/uL3.4-10.8**Please note reference interval change**RBC4.88Hemoglobin13.5Hematocrit43.0MCV68MCV68MCHC31.4Lowg/dL31.4Lowg/dL31.5-35.7RDW13.5Batelets320x10E3/ul155-379
WBC6.0x10E3/uL3.4-10.8WBC6.0x10E3/uL3.4-10.8WBC6.0x10E3/uL3.4-10.8**Please note reference interval change**RBC4.88Hemoglobin13.5g/dL11.1-15.9Hematocrit43.0%34.0-46.6MCV88fL79-97MCH27.7pg26.6-33.0MCHC31.4Lowg/dL31.5-35.7RDW13.5%12.3-15.4Patelets320x10E3/uL15-379
2X Avg.Risk 9.6   7. 3X Avg.Risk 23.4   11.     The CHD Risk is based on the T. Chol/HDL ratio. Othe factors affect CHD Risk such as hypertension, smoking diabetes, severe obesity, and family history of premature CHD.     WBC   6.0   x10E3/uL   3.4-10.8     **Please note reference interval change**     RBC   4.88   x10E6/uL   3.77-5.28     Hemoglobin   13.5   g/dL   11.1-15.9     Hematocrit   43.0   %   34.0-46.6     MCV   88   fL   79-97     MCH   27.7   Pg   26.6-33.0     MCHC   31.4   Low   g/dL   31.5-35.7     RDW   13.5   %   12.3-15.4     Platelets   320   x10E3/ul   155-370
3X Avg.Risk 23.4   11.     The CHD Risk is based on the T. Chol/HDL ratio. Othe factors affect CHD Risk such as hypertension, smoking diabetes, severe obesity, and family history of premature CHD.     WBC   6.0   x10E3/uL   3.4-10.8     **Please note reference interval change**     RBC   4.88   x10E6/uL   3.77-5.28     Hemoglobin   13.5   g/dL   11.1-15.9     Hematocrit   43.0   %   34.0-46.6     MCV   88   fL   79-97     MCHC   31.4   Low   g/dL   31.5-35.7     RDW   13.5   %   12.3-15.4     Platelets   320   x10E3/ul   155-370
The CHD Risk is based on the T. Chol/HDL ratio. Othe factors affect CHD Risk such as hypertension, smoking diabetes, severe obesity, and family history of pre- mature CHD.WBC6.0x10E3/uL3.4-10.8**Please note reference interval change**RBC4.88x10E6/uL3.77-5.28Hemoglobin13.5g/dL11.1-15.9Hematocrit43.0%34.0-46.6MCV88fL79-97MCH27.7pg26.6-33.0MCHC31.4Lowg/dL31.5-35.7RDW13.5%12.3-15.4Platelets320x10E3/ul155-370
WBC     6.0     x10E3/uL     3.4-10.8       **Please note reference interval change**       RBC     4.88     x10E6/uL     3.77-5.28       Hemoglobin     13.5     g/dL     11.1-15.9       Hematocrit     43.0     %     34.0-46.6       MCV     88     fL     79-97       MCH     27.7     pg     26.6-33.0       MCHC     31.4     Low     g/dL     31.5-35.7       RDW     13.5     %     12.3-15.4       Platelets     320     x10E3/ul     155-379
**Please note reference interval change**     RBC   4.88   x10E6/uL   3.77-5.28     Hemoglobin   13.5   g/dL   11.1-15.9     Hematocrit   43.0   %   34.0-46.6     MCV   88   fL   79-97     MCH   27.7   pg   26.6-33.0     MCHC   31.4   Low   g/dL   31.5-35.7     RDW   13.5   %   12.3-15.4     Platelets   320   x10E3/ul   155-379
HBC 4.88 x10E6/uL 3.77-5.28   Hemoglobin 13.5 g/dL 11.1-15.9   Hematocrit 43.0 % 34.0-46.6   MCV 88 fL 79-97   MCH 27.7 pg 26.6-33.0   MCHC 31.4 Low g/dL 31.5-35.7   PDW 13.5 % 12.3-15.4   Platelets 320 x10E3/ul 155-379
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MCV     88     fL     79-97       MCH     27.7     pg     26.6-33.0       MCHC     31.4     Low     g/dL     31.5-35.7       RDW     13.5     %     12.3-15.4       Platelets     320     x10F3/ul     155-379
MCH     27.7     pg     26.6-33.0       MCHC     31.4     Low     g/dL     31.5-35.7       RDW     13.5     %     12.3-15.4       Platelets     320     x10F3/ul     155-379
MCHC     31.4     Low     g/dL     31.5-35.7       RDW     13.5     %     12.3-15.4       Platelets     320     x10F3/ul     155-379
HDW 13.5 % 12.3-15.4 Platelets 320 x10F3/ul 155-379
Platelets 320 ¥10E3/01 155-379
*Plaze pro seference interval charge**
Neutrophils 50 % 40-74
**Please note reference interval change**
Lymphs 40 % 14-46
**Please note reference interval change**
Monocytes 7 % 4-12
**Please note reference interval change**
EDS 3 % 0-5
Rasos 0 % 0.3
Immature Cells

The next patient is a 47-year-old female with chief complaint of depression, anxiety, constipation, and fibromyalgia. Alkaline phosphatase was slightly elevated at 102. LDH, bilirubin, AST, and ALT were normal. This was outside blood work that she had and brought in to her appointment, so we didn't have a GGT level on her. She has diabetes. Her fasting glucose, you can see, is 151. Her uric acid is 7.2.



## Alkaline Phosphatase Isoenzymes

Test Name	Results	Units	Reference Range
Alkaline Phosphatase	110	U/L	33-115
Bone %	29	%	16-56
Bone U/L	32	U/L	5-58
Liver %	56	%	44-84
Liver U/L	62	U/L	5-93
Intestinal %	15	%	<b>H</b> < 14
Intestinal U/L	16	U/L	<b>H</b> < 15

We tested her alkaline phosphatase, and it was normal but borderline high. The intestinal fraction is slightly elevated. I ran an alkaline phosphatase isoenzymes test, so this test can be used to determine where the alkaline phosphatase elevation is coming from, whether it is coming from the bone, the liver, or the intestine.

As you can see here, her intestinal fraction was slightly elevated, one point out of the range. Her total alkaline phosphatase actually on this test was normal but at the high end of the range. Intestinal alkaline phosphatase can be elevated in liver disease, but this patient had no markers of liver dysfunction.

The most important rule of intestinal alkaline phosphatase is detoxifying lipopolysaccharide, or LPS, derived from the cell wall components of Gram-negative gut bacteria, so it is possible that intestinal alkaline phosphatase could increase in states of dysbiosis or disrupted gut microbiome.



Comprehensive Stool And	alysis / Parasitology x3	
Expected/Beneficial flora	Commensel (Imbalanced) flora	Dyshiotic flora
	Commensar (imbalanced) nora	bysbiolic nora
3+ Bacteroides fragilis group	1+ Alpha hemolytic strep	
NG Bitidobacterium spp.	1+ Gamma hemolytic strep	
NG Escherichia coli	3+ Hemolytic Escherichia coli	
NG Lactobacilius spp.		
I+ Enterococcus spp.		
3+ Clostridium son		
NC = No Crowth		
NG = No Growth		
	BACTERIA INFORMATION	
Dysbiotic bacteria and using or acteria and using oversion of beneficial bacteria and increased level Dysbiotic bacteria consist of known pathoger number of factors including: consumption of corral contraceptives or other medications; poor	is of commensal bacteria. Certain commensal bacteria is bacteria and those that have the potential to caus ontaminated water or food, exposure to chemicals th fiber intake and high stress levels.	ria are reported as dysbiotic at higher levels. se disease in the GI tract. They can be present due to at are toxic to beneficial bacteria; the use of antibiotic
	YEAST CULTURE	
Normal flora	Dysbioti	c flora
No veast isolated		
	VEAS	TINFORMATION
MICROSCOPIC YEAST	TEAS	
MICROSCOPIC YEAST	Yeast normally can be found in small quan	ities in the skin, mouth, intestine and mucocutaneou



			DIGESTION ABSORPTIO	N
	Within	Outside	Reference Range	Elastase findings can be used for the diagnosis or the exclusion of exocrine pancreatic
Elastase	> 500		> 200 µg/mL	and chronic pancreatitis and cancer have been reported. Fat Stain: Microscopic determination
Fat Stain	None		None - Mod	of fecal fat using Sudan IV staining is a qualitative procedure utilized to assess fat absorption and to detect steatorrhea. <b>Muscle</b>
Muscle fibers	None		None - Rare	fibers in the stool are an indicator of incomplete digestion. Bloating, flatulence, feelings of "fullness" may be associated with increase in
Vegetable fibers	Rare		None - Few	muscle fibers. Vegetable fibers in the stool may be indicative of inadequate chewing, or eating "on the run". Carbohydrates: The presence of
Carbohydrates	Neg		Neg	reducing substances in stool specimens can indicate carbohydrate malabsorption.
			INFLAMMATION	Luconumet is an annuma appreted at the site of
	Within	Outside	Reference Range	inflammation in the GI tract and elevated levels have been identified in IBD patients. Lactoferrin
Lysozyme*	398		<= 600 ng/mL	inflammation used to diagnose and differentiate IBD from IBS and to monitor patient inflammation levels during active and remission phases of IBD
Lactoferrin	< 0.5		< 7.3 µg/mL	White Blood Cells (WBC): in the stool are an indication of an inflammatory process resulting in the infiltration of loukoottes within the inflational store and the infiltration of loukoottes within the intesting.
White Blood Cells	None		None - Rare	lumen. WBCs are often accompanied by mucus and blood in the stool. <b>Mucus</b> in the stool may
Mucus	Neg		Neg	response to parasympathetic excitability such as spastic constipation or mucous colitis.
			IMMUNOLOGY	Secretory IgA* (sIgA) is secreted by mucosel
	Within	Outside	Reference Range	tissue and represents the first line of defense of the GI mucosa and is central to the normal
Secretory IgA*		627	51 - 204mg/dL	Elevated levels of slgA have been associated with an upregulated immune response.

Sure enough, she had significant insufficiency dysbiosis with significantly elevated sIgA and gut mucosal immune activation.



TEST		RESULT			
Array 2 – Intestinal Antigenic Permeability Screen	IN RANGE (Normal)	EQUIVOCAL*	OUT OF RANGE	REFERENCE (ELISA Index)	
Actomyosin IgA **	4.04			0.0-20	
Occludin/Zonulin IgG	0.79			0.2-1.5	
Occludin/Zonulin IgA	0.30			0.1-1.8	
Occludin/Zonulin IgM			2.13	0.1-2.1	
Lipopolysaccharides (LPS) IgG	0.60			0.1-1.6	
Lipopolysaccharides (LPS) IgA	0.47			0.1-1.8	
Lipopolysaccharides (LPS) IgM			2.06	0.1-2.0	

She was also positive for LPS antibodies and antibodies to occludin and zonulin, IgM on the intestinal permeability test, and this was consistent with elevation of intestinal alkaline phosphatase as a means of detoxifying LPS because it was getting into her bloodstream.



The next markers is 5'-nucleotidase, which is an enzyme found in the liver, intestine, brain, heart, blood vessels, and pancreas. Physiologic function is not well understood, but 5'-nucleotidase specifically catalyzes hydrolysis of nucleotides such as adenosine, 5'-phosphate, and inosine 5'-phosphate. It is similar to alkaline phosphatase in the sense that 5'-nucleotidase has subcellular location in hepatocytes and will increase in hepatobiliary diseases with cholestasis. The levels of 5'-nucleotidase correlate well with alkaline phosphatase in most studies; however, concentrations of each don't necessarily rise proportionally in all people. This means that in some people, 5'-nucleotidase will be elevated with alkaline phosphatase normal, and vice versa. The primary purpose of 5'-nucleotidase clinically is to confirm that high alkaline phosphatase is a marker of liver or gallbladder dysfunction and not bone or intestinal issues. I don't include this in my case review blood panel, but I will often order it as a follow-up test.



The next marker to discuss is lactate dehydrogenase, or LDH. Again, we talked about it in the liver presentation, but I'm going to mention it in the context of gallbladder disease here. Studies have shown that LDH is elevated in gallbladder cancer, cholelithiasis, and chronic cholecystitis. LDH showed an increasing trend from stage 1 to stage 4 of gallbladder cancer, indicating a significant positive association with the disease progression. Specifically, levels of LDH 3 and 4 isoforms appeared significantly more elevated in gallbladder cancer than cholelithiasis or chronic cholecystitis.



If LDH is elevated, look at bilirubin and alkaline phosphatase. If those two are elevated, run LDH isoenzymes. If LDH isoenzymes 3 and 4 are significantly elevated, you would refer out for gallbladder cancer screen. If there is another pattern, then you could address the underlying causes you've discovered and retest. If bilirubin and alkaline phosphatase are not elevated, you should still run LDH isoenzymes to see where the elevation is coming from. Again, I've put the algorithm here on this slide so you can refer to it.