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LC (Liver Cirrhosis)-HbA1c as a Useful Indicator for Mean Plasma Glucose in Patients with Chronic Liver Diseases

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HbA1c and GA Levels in Patients with Chronic Liver Diseases (CLD)

Chronic Liver Diseases

Hypersplenism → **Shortened lifespan of erythrocytes** → **HbA1c ↓**

Decreased hepatic production of albumin → **Prolonged serum albumin catabolism** → **GA ↑**

There is no suitable index for chronic glycemic control in patients with CLD.

Objective

The aim of this study was to explore the useful indicator for mean plasma glucose (MPG) in patients with chronic liver diseases, especially those with liver cirrhosis.

Subject

- 82 inpatients (46 males and 36 female; mean age: 60.4 ±9.2 years) with chronic liver diseases who have been hospitalized at Fukui-ken Saiseikai Hospital.
- 24 subjects (29%) had diagnosed as diabetes mellitus.
- Classification of chronic liver diseases was as follows

Chronic active hepatitis (CAH)	21 cases
Liver cirrhosis (LC)	61 cases

(Child's classification : group A: 24 cases, B: 23 cases, and C: 14 cases.)

Exclusion Criteria

Patients who were unable to intake foods, complicated those with renal disorders or excessive stress (fever, pain and diarrhea) and those treated with interferon were excluded from this study.

Research Design and Method

- HbA1c, GA
- Mean plasma glucose (MPG) was defined as average of the seven points of plasma glucose.
- HPT, TP, ALB, T Bil, D Bil, PLT, ChE, TChol

Estimated HbA1c

Corrected HbA1c was calculated by applying the MPG data into the regression formula according to DCCT (Rohlfing et al., 2002).

Estimated HbA1c = MPG (mg/dl) / 35.6 + 1.87

GA / 3

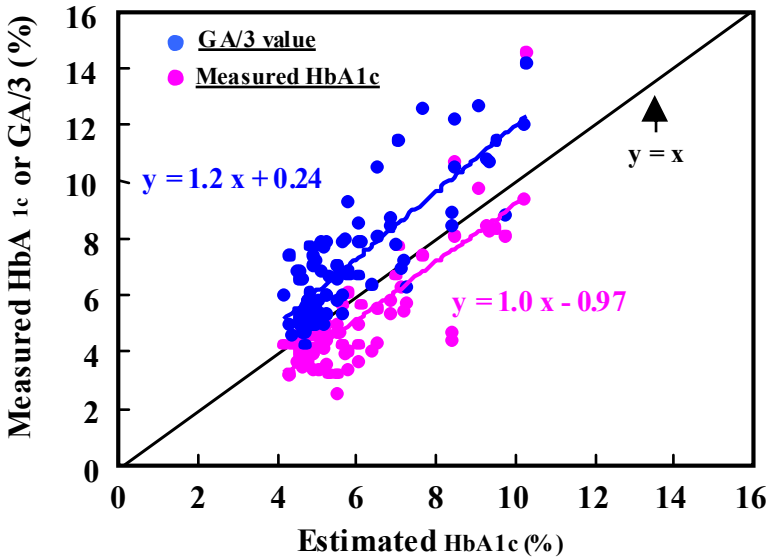
GA levels were roughly estimated at approximately 3-fold higher than HbA1c levels.

LC (liver cirrhosis)-HbA1c

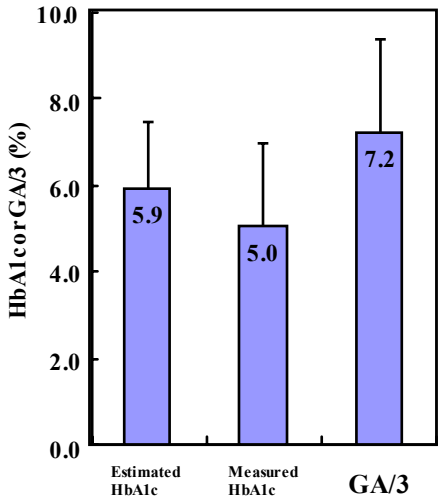
LC-HbA1c was defined by the following equation.

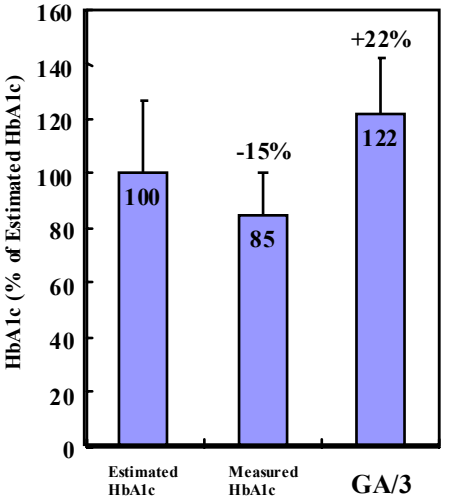
LC-HbA1c = (Measured HbA1c + GA/3) x 1/2

Correlations between Estimated HbA1c and Glycemic Control Makers



Comparison between Estimated HbA_{1c}, Measured HbA1C and GA/3





Stepwise Multivariate Regression Analyses on HbA_{1c} (%) and Glycated Albumin (GA)

Target variable : *Measured HbA1c*

Confounding variables :
Age, Mean PG, HPT, ChE, Alb, PLT

	Regression coefficient	F value	p value
Mean BG	0.819	209.1	<0.0001
ChE	0.251	14.0	0.0256
HPT	0.148	4.9	0.0584

Target variable : *GA/3*

Confounding variables :
Age, Mean PG, HPT, ChE, Alb, PLT

	Regression coefficient	F value	p value
Mean BG	0.823	175.7	<0.0001
HPT	-0.217	12.2	0.0243

Target variable :
Ratio of measured HbA1c to estimated HbA1c

Confounding variables :
Age, Mean PG, HPT, ChE, Alb, PLT

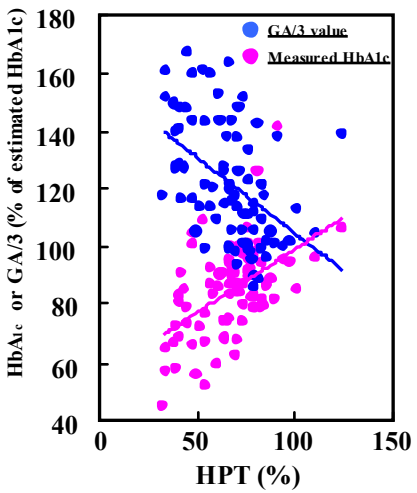
	Regression coefficient	F value	p value
ChE	0.367	11.0	0.0297
HPT	0.315	8.1	0.0275

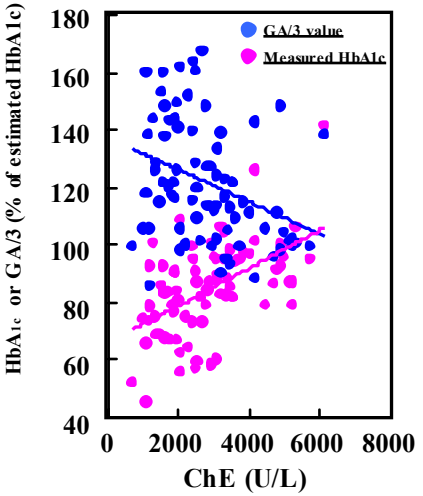
Target variable :
Ratio of GA/3 to estimated HbA1c

Confounding variables :
Age, Mean PG, HPT, ChE, Alb, PLT

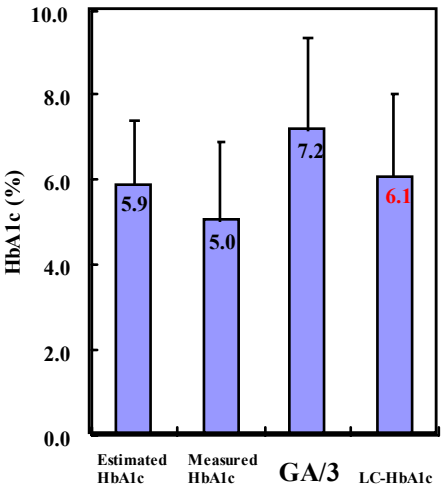
	Regression coefficient	F value	p value
HPT	-0.480	22.4	0.0036

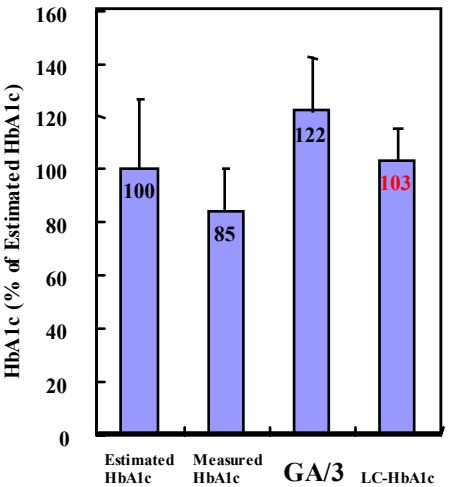
Correlations between Hepaplastin Test or Cholinesterase and Glycemic Control Makers





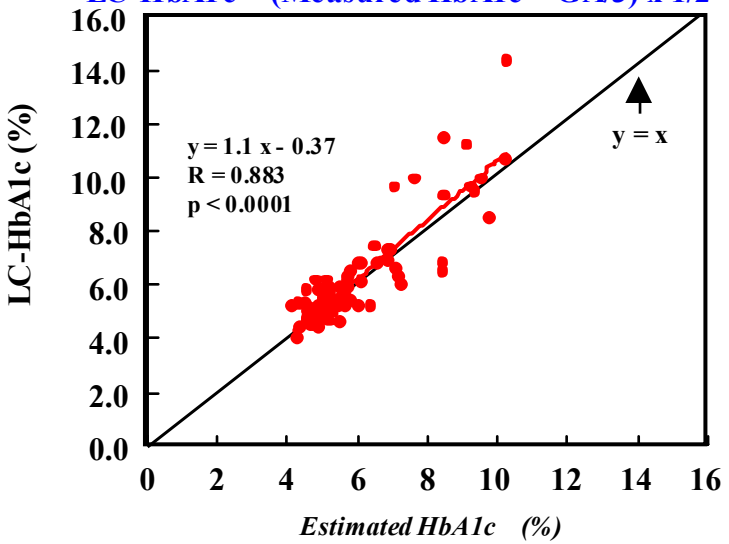
Comparison between Estimated HbA1c and LC-HbA1c



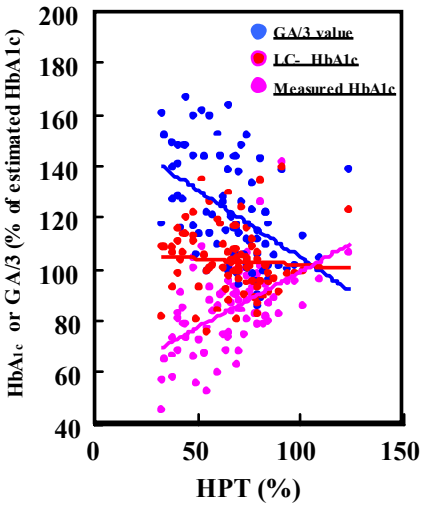


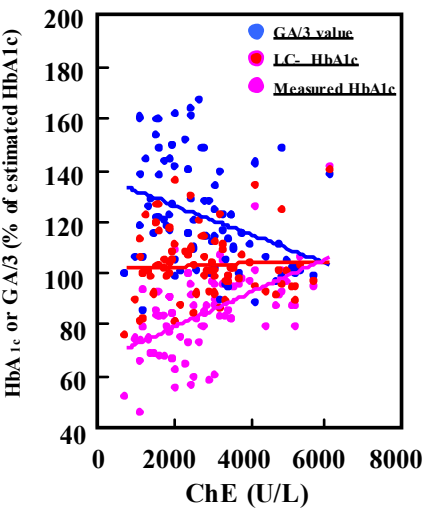
Correlation between Estimated HbA_{1c} and LC-HbA_{1c}

LC-HbA1c = (Measured HbA1c + GA/3) x 1/2

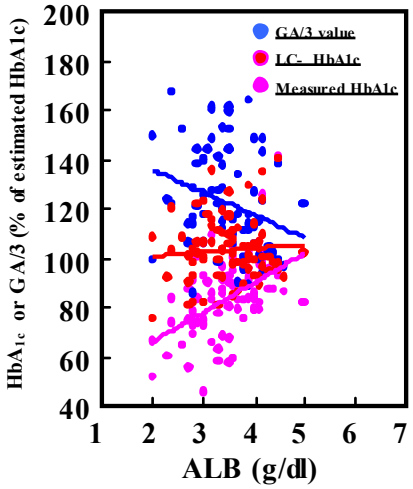


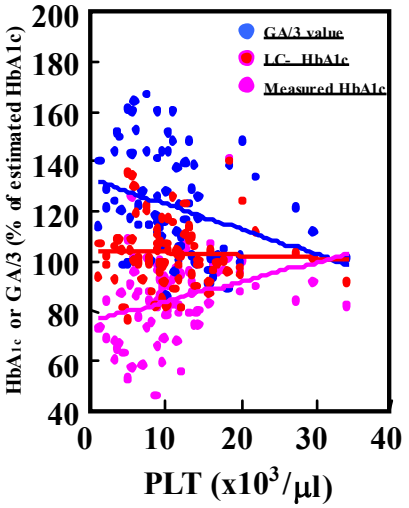
Correlations between Hepaplastin Test or Cholinesterase and LC-HbA_{1c}





Correlations between ALB or PLT and LC-HbA1c





Single and Multivariate Regression Analyses on LC- HbA1c

	Single regression analysis		Multivariate regression analysis		
	R	p	β	F	p
Mean PG	0.883	<0.0001	0.872	239.0	<0.0001
age	0.101	0.3673	Not entered		
ALB	0.040	0.7205	Not entered		
HPT	0.051	0.6492	Not entered		
ChE	0.013	0.9096	Not entered		
PLT	0.109	0.3334	Not entered		

MPG was found to be a significant explanatory variable for LC-HbA_{1C}. LC-HbA_{1C} was not influenced by various hepatic function tests such as ChE, HPT, Alb and PLT.

Results

1) In patients with chronic liver diseases, HbA_{1C} and GA were set lower and higher than the real status of chronic glycemic control, respectively.

2) This discrepancy was lineally increased in accordance with decreasing in hepatic function test such as HPT and ChE.

3) LC-HbA_{1C}, a novel glycemic control marker defined by the average of measured HbA_{1C} and GA/3, was correlated well with estimated HbA_{1C}, and was close to the estimated HbA_{1C} values itself, indicating that LC-HbA_{1C} is an adequate indicator for chronic glycemic control, that is not affected by hepatic function tests.

Conclusions

LC-HbA_{1C} (average value of HbA_{1C} and GA/3) reflects chronic glycemic control status more accurately without being affected by hepatic function.