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Computerized Medical Balascopy (COMB) is a methodology and a cascade of fifteen methods for detection, extraction, quantification, assessment, and graphical representation of multiple relationships within a given system for pattern cognition and pattern recognition for diagnostic purposes (1, 2). COMB is applicable to any kind of system with measurable parameters of any nature. Currently all COMB Programs are written on Pascal for IBM PC (3).

COMB allows the detection of six types of quantitatively and qualitatively distinct relationships between different parameters. These types constitute one normal (N.) and five abnormal (imbalanced) relationships: Normal but Inverted (Ni), Integ- (I.), Disintegrated (D.), Integrated and Inverted (Ii), Disintegrated and Inverted (DI). Four of them (I., D., Ii., Di.,) also can be evaluated by severity and lability of imbalance.

In order to demonstrate diagnostic possibilities of COMB we will compare a Balascopically normal case versus a case with seemingly normal routine metabolic parameters (4). A case of Balascopically normal metabolism is presented in Table 1, Diagram 1 and Diagram 2.

Table 1. ACTUAL COMUTER PRINTOUT of BALASCOPY II of ROUTINE BIOCHEMICAL TESTS IN A BALASCOPICALLY NORMAL CASE

NORM / 01-16-85 BALASCOPY II

Dx: ---------- NORMAL PATTERN ----------

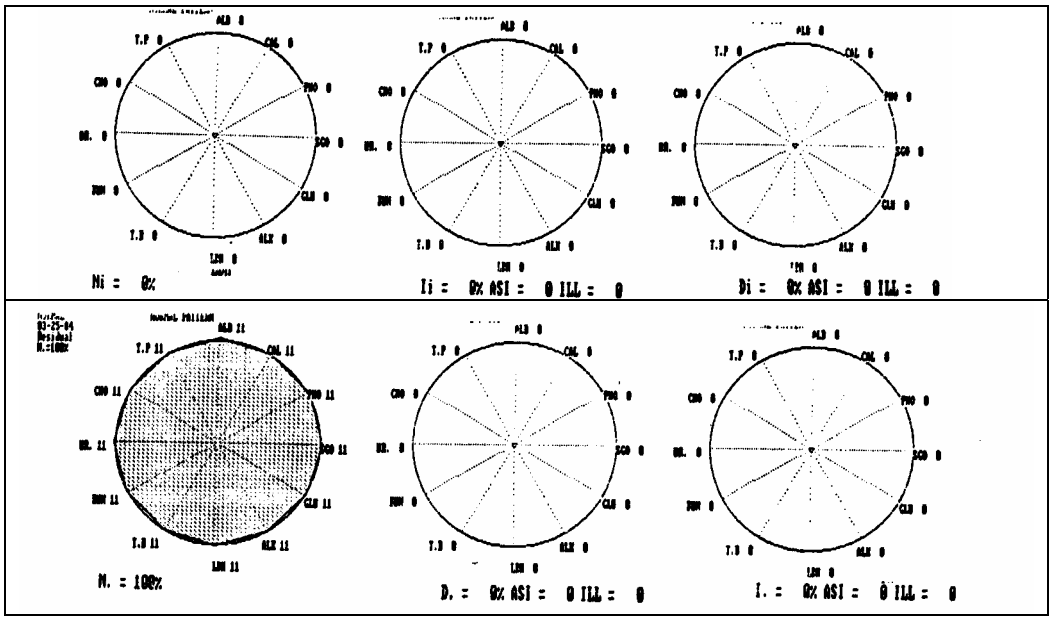
COMPLETE SET OF RELATIONSHIPS BETWEEN 12 PARAMETERS EXPRESSED BY SEVERITY AND TYPE OF IMBALANCE

ALBUM—CALCI	N.	PHOS-GLUC	N.	GLUC-T.PRO	N.
ALBUM-PHOS	N.	PHOS-ALK.P	N.	ALK.P-LDH	N.
ALBUM-SG0T	N.	PHOS-LDH	N.	ALK. P-LDH	N.
ALBUM-GLUC	N.	PHOS-T.BIL	N.	ALK.P-BUN	N.
ALBUM-ALK.P	N.	RHOS-BUN	N.	ALK.P-UR.AC	N.
ALBUM-LDH	N.	PHOS-UR.AC	N.	ALK P-CHOL.	N.
ALBUM-T.BIL	N.	PHOS-CHOL.	N.	ALK.P-T.PRO	N.
ALBUM-BUN	N.	PHOS-T.PRO	N.	LDH-T.BIL	N.
ALBUM-UR.AC	N.	SGOT-GLUC	N.	LDH-BUN	N.
ALBUM-CHOL.	N.	SGOT-ALK.P	N.	LDH-UR.AC	N.
ALBUM-T.PRO	N.	SGOT-LDH	N.	LDH-CHOL.	N.
CALCI-PHOS	N.	SGOT-T.BIL	N.	LDH-T.PRO	N.
CALCI-SGOT	N.	SGOT-BUN	N.	T.BIL-- BUN	N.
CALCI-GLUC	N.	SGOT-UR.AC	N.	T.BIL-UR.AC	N.
CALCI-ALK.P	N.	SGOT-CHOL.	N.	T.BIL.-CHOL	N.
CALCI-LDH	N.	SGOT-T.PRO	N.	T.BIL-T.PRO	N.
CALCI-T.BIL	N.	GLUC-ALK.P	N.	BUN-UR.AC	N.
CALCI-BUN	N.	GLUC-LDH	N.	BUN-CHOL.	N.
CALCI-UR.AC	N.	GLUC-T.BIL	N.	BUN-T.PRO	N.
CALCI-CHOL	N.	GLUC-BUN	N.	UR.AC-CHOL	N.
CALCI-T.PRO	N.	GLUC-UR.AC	N.	UR.AC-T.PRO	N.
PHOS -SGOT	N.	GLUC-CHOL.	N.	CHOL.-T.PRO	N.

Table 1 shows that all possible pairs of parameters have normal relationships. Diagrams 1 and 2, which are designed for graphical representation of imbalances, are empty because no Balascopical abnormalities are detected in a normal case. Presented below (Table 2, Diag. 3, 4) is an application of COMB for an analysis of a prototype case of Hypogammaglobulinomia (4)

Diagram 1.

BALASCOPY III. FREQUENCY OF INVOLVEMENT OF EACH BIOCM41CAL PARAMEMM IN DIFFERENT TYPES OF BALASCOPIC RELATIONSHIPS.



N. = Normal I. = Integrated D. = Disintegrated

Ni = Normal+Inverted Ii =

Integrated+Inverted Di = Disinteqrated+Inverted

ASI= Average Severity of Imbalance

ILL Imbalance Lability Level

Diagram 2.

BALASCOPY IV. STRUCTURES OF DIFFEF04T TYPES OF METABOLIC RELATIONSHIPS

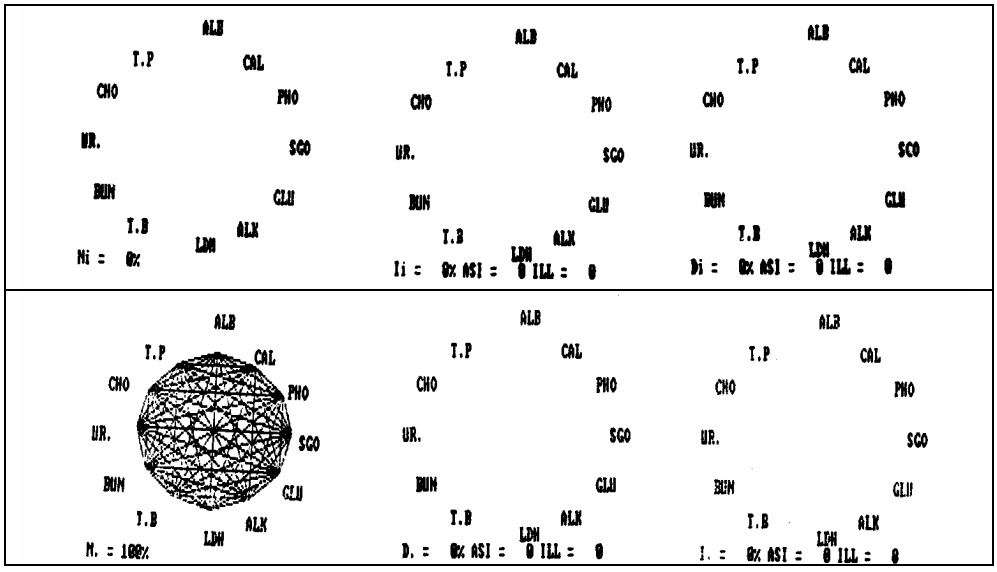


Table 2. ACTUAL COMPUTER PRINTOUT of BALASCOPY II of ROUTINE BIOCHEMICAL TESTS IN A METABOLICALLY NORMAL CASE OF HYPOGAMMAGLOBULINEMIA

WO-538 / 12-20-83 BALASCOPY II

Dx._____HYPOGAMMAGLOBLINEMIA_____

COMPLETE SET OF RELATIONSHIPS BETWEEN 12 PARAMETERS EXPRESSED BY SEVERITY AND TYPE OF IMBALANCE

ALBUM-CALCI		N.	PHOS-GLUC		N.	GLUC-T.PRO		N.
ALBUM-PHOS		N.	PHUS-ALK.P		N.	ALK.P-LDH		N.
ALBUM-SGOT	2%	D.	PHOS-LDH		N.	ALK.P-T.BIL	*	Ni
ALBUM-GLUC		N.	PHOS-T.BIL		N.	ALK.P-BUN		N.
ALBUM-ALK.P		N.	PHOS-BUN		N.	ALK.P-UR.AC		N.
ALBUM-LDH	1%	D.	PHOS-UR.AC	*	Ni	ALK.P-CHOL.		N.
ALBUM-T.BIL		N.	PHOS-CHOL.		N.	ALK.P-T.PRO	2%	I.
ALBUM-BUN		N.	PHOS-T.PRO		N.	LDH-T.BIL	*	Ni
ALBUM-UR.AC		N.	SGOT-GLUC		N.	LDH-BUN		N.
ALBUM-CHOL.		N.	SGOT-ALK.P	*	Ni	LDH-UR.AC		N.
ALBUM-T.PRO	12%	D.	SGOT-LDH	*	Ni	LDH-CHOL.		N.
CALCI-PHOS		N.	SGOT-T.BIL	*	Ni	LDH-T.PRO		N.
CALCI-SGOI		N.	SGOT-BUN		N.	T.BIL-BUN		N.
CALCI-GLUC		N.	SGOT-UR.AC		N.	T.BIL-UR.AC		N.
CALCI-ALK.P		N.	SGOT-CHOL.		N.	T.BIL-CHOL.		N.
CALCI-LDH		N.	SGOT-T.PRO		N.	T.BIL-T.PRO	9%	I.
CALCI-T.BIL		N.	GLUC-ALK.P		N.	BUN-UR.AC		N.
CALCI-BUN		N.	GLUC-LDH		N.	BUN-CHOL.		N.
CALCI-UR.AC		N.	GLUC-T.BIL	*	Ni	BUN-T.PRO	6%	I.
CALCI-CHOL.		N.	GLUC-BUN		N.	UR.AC-CHOL.		N.
CALCI-T.PRO	65%	I.	GLUC-UR.AC	3%	D.	UR.AC-T.PRO	18%	I.
PHOS-SGOT		N.	GLUC-CHOL.		N.	CHOL.-T.PRO	35%	I.

Hypogammaglobulinemia is a condition which has distinct diagnostic immunological characteristics but is considered metabolically normal by twelve routine biochemical parameters. Table 2 indicates that these seemingly normal parameters actually have 17 single pairs of parameters with abnormal (imbalanced) relationships. For example, relationships between Albumin and Total Protein is abnormal. Their imbalance is categorized as Disintegrated (D.). Severity of this imbalanoe is 12%.

Table 2 contains a great deal of information which is partially presented in easily identifiable graphic form as different patterns, each with numerical characteristics at Diagrams 3 and 4. These patterns can be visually analyzed by size, contour and mutual relationships. Their numerical characteristics make it possible to evaluate Balascopic patterns by statistical methods.

SIGNIFICANCE

Computerized Medical Balascopy, as a medical application of Balascopic methodology, can be used to facilitate diagnosing and monitoring of patient condition, early recognition of diseases, and as an effective research tool for detecting and describing new syndromes, prognostically different subtypes of known diseases, and for many other purposes.

Balascopic information, which is not available from any other existing modality, represents a new class of knowledge and might open up a new way of studying mechanisms of disease and designing individualized therapeutic approaches.

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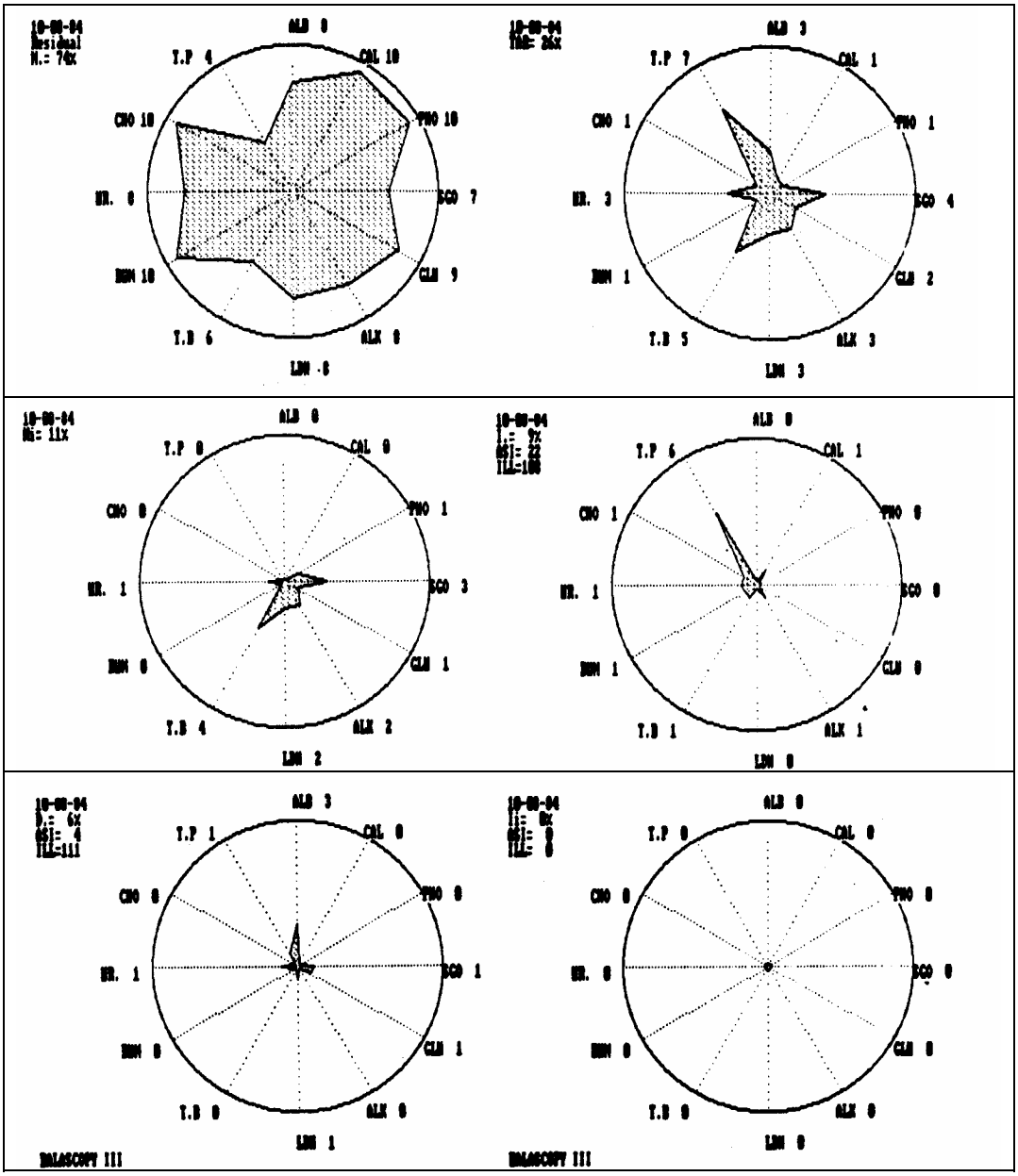
Diagram 3.

FREQUENCY OF INVOLVEMENT OF EACH BIOCHEMICAL PARAMETER
IN DIFFERENT TYPES OF BALASCOPIC RELATIONSHIPS IN HYPOGAMMAGLOBULINEMIA
(WHICH PARAMETER – HOW MANY TIMES – IN WHAT RELATIONSHIPS)

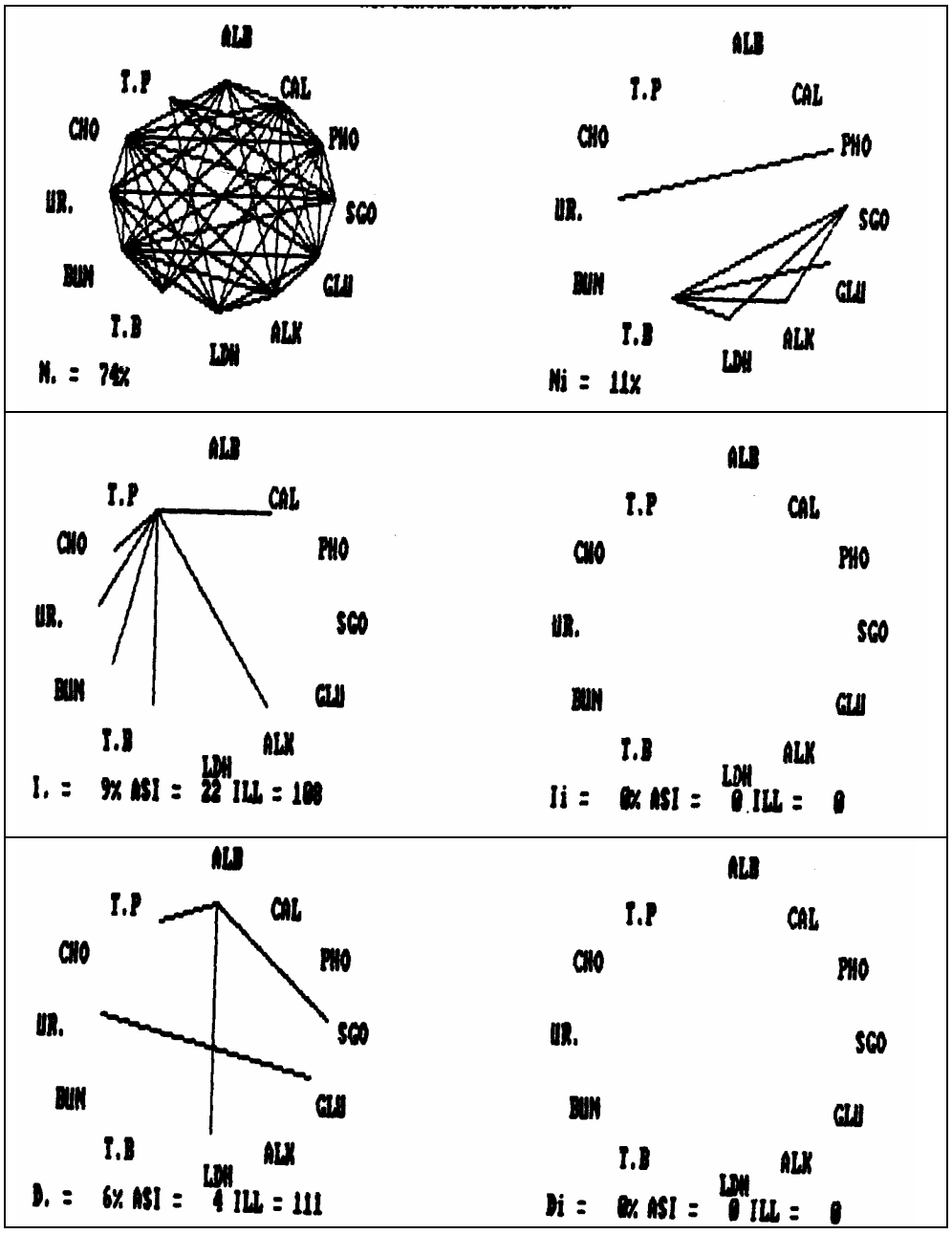


Residual N. = Normal I. = Integrated D. = Disintegrated
Ni = Normal+Inverted Ii = Integrated+Inverted Di = Disintegrated+Iriverted
TAR = Total Abnormal Relationships (Ni + I. + Ii + D. + Di)
ASI = Average Severity of Imbalance
UL = Imbalance lability lavel

Diagram 4.

STRUCTURES OF DIFFERENT TYPES OF BALASCOPIC RELATIONSHIPS
BETWEEN BIOCHEMICAL PARAMETERS IN HYPOGAMMAGLOBULINEMIA
(WHICH PAIR OF PARAMETERS - IN WHAT RELATIONSHIPS)

HYPOGAMMAGLOBULINEMIA



N. = Normal
Ni = Normal+Inverted
I. = Integrated
Ii = Integrated+Inverted
D. = Disintegrated
Di = Disintegrated+Inverted
ASI= Average Severity of Imbalance
ILL Imbalance Lability Level