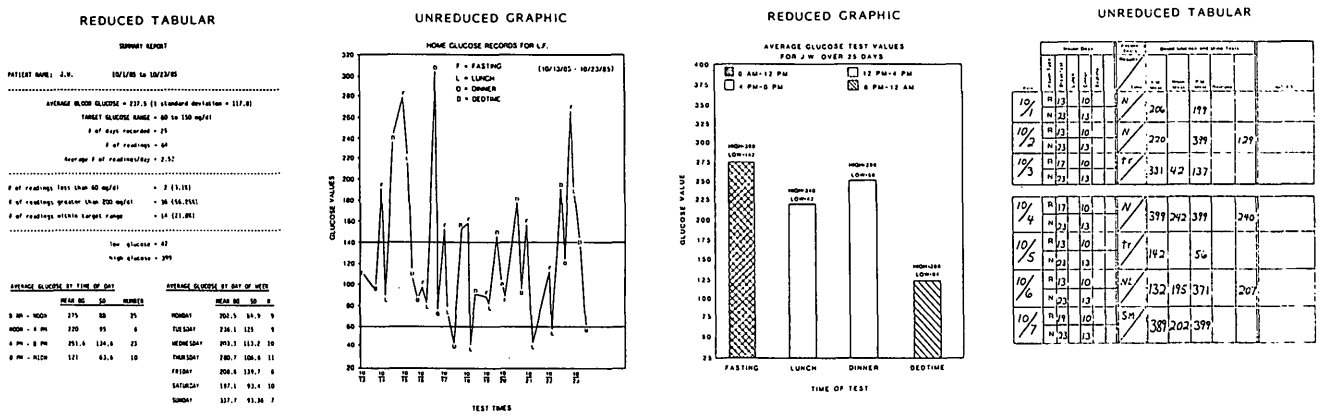

FIG. 1. Examples of SMBG data formats.

traditional logs identified the Somogyi phenomenon ($P = .04$).

The size of our pediatric resident cohort severely limited our power to detect statistically significant main effects. These data indicate that tabular format and data reduction are two characteristics of computerized SMBG displays that facilitate the identification of patterns of metabolic control. Tabular formats (compared with graphs) were associated with a 75% increase in correct interpretation of a stable pattern of hypoglycemia due to overinsulinization. Correct identification of the Somogyi phenomenon was 3–4 times more likely among physicians using data-reduced formats compared with unreduced data. Moreover, in both cases, combining data reduction and tabular format (i.e., statistical tables) increased respondents' likelihood of making correct decisions.

Because subjects in this study were residents, caution should be taken in generalizing these results. Perhaps the advantages of tabular format and data reduction would be diminished with more experienced users. These results clearly show that computer-manipulated SMBG data do not eliminate deficits in clinical knowledge. Thus, we have two suggestions for the future development of computerized SMBG systems. First, as knowledge of the pattern-specific utility of display format increases, microcomputers can be employed as teaching tools. Computer-assisted instruction is well suited for teaching situations that require a sensitive, swift, and tireless taskmaster. Programmed tutorial lessons in numeric or visual pattern recognition could help potential users develop their diagnostic expertise as it relates to this new technology. Second, the sheer analytic power of microcomputers is underutilized by current SMBG systems. The statistical tabling of data seems to improve the decision making of users. But why stop with percentages, means, and standard deviations? Further statistical analysis could evaluate the goodness of fit of a patient's data with respect to standard patterns for euglycemia, Somogyi, and other common deviations from normal. Output could be in the form of a probability estimate, indicating the likelihood of being correct if a given diagnosis were attached to the SMBG data in question. We do not envision these data replacing human judgment; rather, they would offer welcome empirical corroboration for decisions that physicians must constantly make.

DAVID G. MARRERO, PhD
STEVEN A. MAZZUCA, PhD
MICHAEL P. GOLDEN, MD

ACKNOWLEDGMENT

This research was supported in part by the National Institute of Arthritis, Diabetes, and Digestive and Kidney Diseases (PHS P60-DK-20542).

From the Departments of Pediatrics and Medicine, Indiana University School of Medicine, Indianapolis, Indiana.

Address correspondence and reprint requests to David G. Marrero, PhD, Regenstrief Health Center, Regenstrief Institute, 1001 W. 10th Street, Indianapolis, IN 46202.

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Is Difference of Arterial and Venous Oxygen Content a Possible Marker for Diabetic Foot?

In Japan, the incidence of diabetic gangrene seems to be increasing (1,2). Since 1978, 606 diabetic patients have been admitted to our clinic—29 with gangrene—but little is known about the pathogenesis of gangrene and there are few useful methods for screening. To investigate the disturbance of tissue-oxygen utilization in diabetic gangrene, difference of arterial and venous ox-

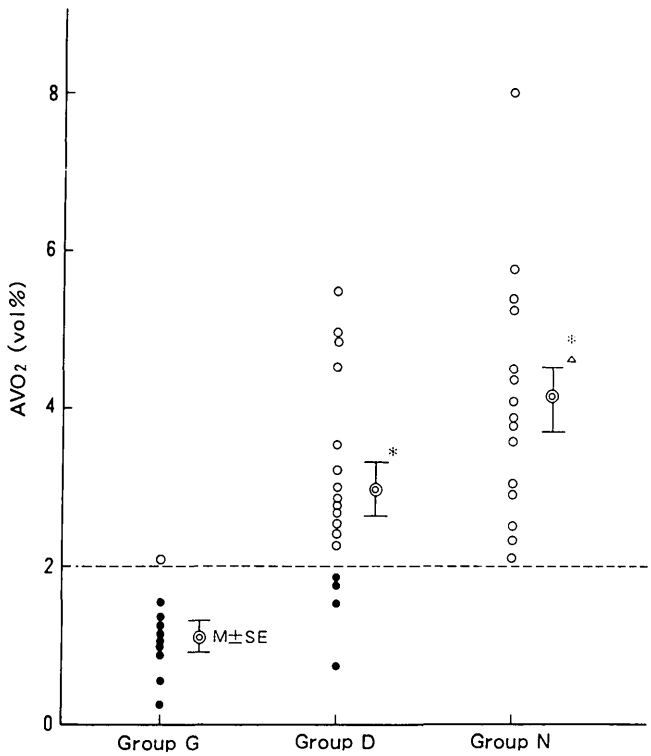

FIG. 1. Difference of arterial and venous oxygen content (A-VΔO_2) of subjects with A-VΔO_2 ≤2 vol% (●) and >2 vol% (○) in groups G (n = 10), D (n = 17), and N (n = 15). *Dotted line* indicates lower limit of normal range (2 vol%). *P < .001 vs. group G; $^{\Delta}P$ < .05 vs. group D.

ygen content (A-VΔO_2) in the foot was determined in type II (non-insulin-dependent) diabetic patients with foot gangrene [group G: n = 10, aged 69 ± 8 yr, fasting blood glucose (FPG) 160 ± 68 mg/dl], type II diabetic patients with intact skin (group D: n = 17, aged 66 ± 9 yr, FPG 179 ± 72 mg/dl) and nondiabetic control subjects (group N: n = 15, aged 66 ± 11 yr, FPG 95 ± 5 mg/dl). Informed consent was obtained from them. Only 4 in group G had a clinical history of intermittent claudication and/or the absence of peripheral pulse. All in group G and 14 in group D had reduced vibration sensation in the toe and/or absence of ankle tendon reflex.

Blood was drawn from the brachial artery and great saphenous vein without stasis at the level of ankle in a 22–24°C room. Both hemoglobin (Hb) and blood gas were determined by the autoanalyzer and blood oxygen content was calculated as follows: O_2(vol%) = 1.39 × Hb × O_2 saturation + 0.0031 × P_{O_2}. A-VΔO_2 = arterial O_2 − venous O_2. Arterial pH, P_{O_2}, O_2 saturation, and P_{CO_2} were equivalent among three groups. In contrast, both venous P_{O_2} and O_2 saturation in group G (63 ± 15 mmHg, 90 ± 3%, respectively) were significantly higher than those in group N (43 ± 6 mmHg, P < .01; 73 ± 7%, P < .01; respectively). As shown in Fig. 1, A-VΔO_2 in group G (1.1 ± 0.5 vol%) was significantly lower than that in group D (3.0 ± 1.3 vol%, P < .001) and group N (4.2 ± 1.6 vol%, P < .001). Nine group G, 4 group D, and 0 group N subjects had A-VΔO_2 <2 vol%. Diabetic patients with A-VΔO_2 <2 vol% had significantly higher incidence of gangrene than diabetic patients with A-VΔO_2 >2 vol% (P < .01). Increase in peripheral venous P_{O_2} in the diabetic patients with foot ulcers had already been reported (3). However, A-VΔO_2 was much more discriminative than either venous P_{O_2} or O_2 saturation for subjects with and without gangrene.

Our data demonstrate reduced A-VΔO_2 in diabetic patients with gangrene compared with subjects without gangrene. However, the precise mechanism is not clear. There are several possibilities for explanation of reduction in A-VΔO_2; e.g., increased arteriovenous shunting due to autonomic neuropathy, decreased oxygen transfer through capillary wall, decreased oxygen demand, and increased arterial blood flow in diabetic foot with gangrene. Metabolic control may also affect A-VΔO_2. However, subjects were neither hypoglycemic nor hyperglycemic at the time of measurement, and correlation between HbA_1 and A-VΔO_2 was not statistically significant. On the other hand, significant correlation between A-VΔO_2 and coefficient of variation in R-R interval (P < .01) supports the idea that as same mechanism as lumbar sympathectomy (5), development of arteriovenous shunting due to diabetic autonomic neuropathy may play an important role on decrease in A-VΔO_2. Further longitudinal studies are needed to verify whether A-VΔO_2 <2 vol% is highly predictable for diabetic gangrene.

YASUO KIDA, MD
ATSUNORI KASHIWAGI, MD
YOSHIHIKO NISHIO, MD
MITSUYOSHI KODAMA, MD
NANAMI ABE, MD
YUKIO SHIGETA, MD

From the Third Department of Medicine, Shiga University of Medical Science, Shiga, Japan.

Address correspondence and reprint requests to Yasuo Kida, MD, The Third Department of Medicine, Shiga University of Medical Science, Ohtsu, Shiga 520–21, Japan.

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