THE EFFECT OF PARTIAL HEPATECTOMY ON THE BLOOD VOLUME IN THE WHITE RAT

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In their review of the literature concerning the plasma proteins, Madden and Whipple (1) referred to the depression of the plasma proteins which occurs in rats within twenty-four hours after partial hepatectomy, and stated, “It would be interesting to know something about blood volume at this time in these rats.” This work is concerned with the determination of blood volumes at varying periods after partial hepatectomy in the white rat.

METHODS. White male rats of Wistar strain, four to six months of age, raised on a stock diet, were used. Partial hepatectomy, under ether anesthesia, was performed according to the procedure of Higgins and Anderson (2). Intact animals of the same age served as controls. After operation the animals were continued on the stock diet, and were allowed food and water ad libitum. Blood volume determinations were made with the dye method of Gibson and Evans (3) and Gibson and Evelyn (4), as modified for rats by Beckwith and Chanutin (5). For this procedure the animals were anesthetized with intraperitoneal sodium-pentobarbital, with precautions outlined by Sheifley and Higgins (6). In a few instances two blood volume determinations were made on the same rat at different periods after partial hepatectomy, but in most cases the animals were sacrificed after one determination.

RESULTS. Data for total blood volume, plasma and red cell volumes are presented graphically in figure 1. Plasma and red cell volumes decreased comparably during the first days, and as a result none of the values for total blood volume fell within the control range during this period. Thereafter the plasma volume rose progressively, reaching the average control value on the seventh day; the individual and average values for plasma volume continued to increase appreciably and in many cases were greater than those of the control group. The majority of values for red cell volume were within the control range on the seventh day, but the average value had not reached the control level on the twentieth day. The return of the total blood volumes to the control level about the ninth day was due principally to the increased plasma volumes.

Blood volume determinations on animals subjected to simple laparotomy alone showed no deviation from the control range on the first and third days after operation.

COMMENT. It has been observed (7) that following cessation of a moderate hemorrhage, the blood volume is quickly restored to its previous level, presum-
ably by absorption of extravascular fluid; and that the percentage of red cells and hemoglobin is further decreased by this dilution. In the present experiment the decreased blood volume was due to diminution in both the plasma volume and the red cell volume, but since the plasma volume did not increase until five days after operation, at which time the red cell volume also rose slightly, the blood volume changes do not appear to be the result of simple hemorrhage. Moreover, the alteration of blood volume seems greater than can be accounted for by blood loss incident to operation and removal of liver tissue.

The concentration of the plasma albumin may be one factor in the regulation of the plasma volume (8), but has been found to be significant only when the red cell volume is constant (9). Chanutin and associates (10) found that the concentration of the plasma albumin is decreased within twenty-four hours after partial hepatectomy, and that it tended to remain low until after the eighteenth day. Similarly, values for total protein were depressed within twenty-four hours, but returned to the control range on the fifth day. From the present observations, it would appear that the plasma volume and the total blood volume may return to control levels even though the plasma albumin concentration remains depressed.

**SUMMARY**

Plasma, red cell and total blood volumes were determined in partially hepatectomized rats, at frequent intervals after operation. During the first forty-eight hours each of these was decreased markedly. The plasma volume reached the
control level on the seventh day after operation; total blood volume on the ninth day; and the majority of red cell volume determinations were within the control range on the seventh day.

REFERENCES

(2) HIGGINS, G. M. AND R. M. ANDERSON. Arch. Path. 12: 186, 1931.