ing as a process of repair has imparted resistance to the liver against this hepatoxic agent. There occurs but slight evidence of epithelial injury and hepatic function as indicated by the use of phenoltetrachlorphthalein may or may not be depressed from the pathological normal established by the liver as a result of an atypical type of fixed cell repair.

7864 C

Effects of a General Anesthetic (Sodium Amytal) on the Erythrocyte Count Following Hemorrhage.

ROBERT ELMAN, DAVID O. WEINER, AND WARREN H. COLE. (Introduced by Evarts A. Graham.)

From the Department of Surgery, Washington University School of Medicine, and Barnes Hospital, St. Louis, Missouri.

Although it is generally agreed that there is a reduction of the erythrocyte count after hemorrhage due presumably to a dilution of the circulating blood nearly all of the evidence of this phenomenon has been obtained some hours, *i. e.*, 24 or more, after bleeding. The behavior of the red blood count within a few hours after hemorrhage has not been extensively investigated, and among observers there is considerable disagreement, some finding an increase in the cell count indicating concentration and others finding a decrease indicating dilution.*

During other experiments it was noticed that the effect of general anesthesia seemed to have a very marked influence on the behavior of the red blood count after hemorrhage. A series of experiments were then undertaken, 13 in all. In 6 of them the blood was removed from the circulation from the femoral artery under local (novocaine) anesthesia, in the others after the induction of general anesthesia by means of the injection of sodium amytal intravenously. The amount of drug given did not exceed 50 mg. per kilogram of body weight in any case. However, many dogs received less than this amount for the injection was given slowly and discontinued as soon as the animal was deeply asleep. A single bleeding was done in each case amounting to from 3 to 4% of the body weight. Preliminary observations of the red blood cell count, venous, capillary and arterial, with the animal under general as well as without

*Lack of space precludes discussion of these observations.

anesthesia for a number of hours showed no significant alterations. In the 13 dogs observations were made before hemorrhage and for several hours after. The same position of the animal was maintained during the course of the experiment. Blood counts were obtained of capillary blood as well as venous, the latter being obtained through puncture of the right leg vein, the former from the base of the ear.

As can be seen from the accompanying charts there is a very definite difference between the 2 groups of experiments. In the dogs bled under general anesthesia there was in most cases not very marked changes in the red blood count. With a few exceptions, however, the change was an increase and in one instance there was a concentration as high as 31%. In contrast to these findings there was a reduction in the red blood count in each of the cases of hemorrhage performed without general anesthesia, indicating very defi-

CHART I.

Red Blood Counts (R.B.C.) before and after hemorrhage (local anesthesia). All counts are of capillary blood except those marked "V" which are venous.

Dog	Wt., Age, Sex and R.B.C. (in millions)	% of body Wt. bled	Red Blood Count After Bleeding (in millions) 1 hr.	2 hr.	3 hr.	4 hr.	5 hr.	6 hr.	Maximum change in R.B.C. %
1	21 kg. old male								
	6.52	3.8							—25
	6.36 V		5.5V	4.7V	died				died
2	5.4 kg. old male								
	5.4	3.7		5.0			3.9	3.9	—24
	4.92 V			5.3V			4.0V		—23
3	7.5 kg. young male								
	6.17	3.3			4.2	4.2			—32
	5.66 V				4.1V				—27
4	5 kg. young male								
	4.54	4.5			2.8				—35
	4.441 V				2.6V				—42
5	8 kg. old male								
	7.9	3.1	6.7	6.8		6.4	6.4		—19
	7.8 V		6.8V	6.9V	6.5V				—18
6	5 kg. young female								
	6.4	4.0	5.0		5.3		5.2		—20
	6.4 V				4.9V		5.0V		—29

nite dilution under these circumstances. This dilution amounted in one case to a reduction of 42% in the erythrocyte count, and in no case was less than 18%.

In a few instances red blood cell counts were repeated the next day, *i. e.*, 24 hours after the hemorrhage. During this time the animals had access to no food or water. In the dogs bled without general anesthesia there was in only one instance any further change in the red blood count, and it was an additional dilution.

In 3 instances in the other group, the 24-hour count was made after the effect of sodium amytal had worn off and when the dogs were conscious, alert and active. They showed a very marked re-

CHART II.

Red Blood Counts (R.B.C.) before and after hemorrhage (sodium amytal anesthesia). All counts are of capillary blood, except those marked "V," which are venous.

Dog	Wt., Age, Sex and R.B.C. (in millions)	% of body Wt. bled	Red Blood Count After Bleeding (in millions) 1 hr.	2 hr.	3 hr.	4 hr.	5 hr.	Maximum change in R.B.C. %
7	5 kg. young female							
	5.88	3.0	5.4		5.5		6.0	— 7
	5.0 V		5.9V		5.7V		5.6V	+18
8	12 kg. young male							
	5.52	3.5	5.9			6.2	7.2	+31
	5.99 V		6.6V			7.6V	7.1V	+27
9	8 kg. young male							
	5.82	3.7					5.4	— 7
	5.53 V						6.0V	+ 8
10	7 kg. old female							
	5.72	3.7					5.6	— 1
	5.86 V						6.1	+ 5
11	13 kg. young male							
	6.4	3.5		5.7	5.8			—12
	5.9 V			6.6	6.1			+11
12	12.2 kg. old male							
	7.6	3.8	7.5	7.4	7.4		7.5	+ 2
	7.7 V		7.5V	7.6V			7.7V	— 2
13	10 kg. young male							
	7.4	4.1		7.3	7.9	7.5	7.3	+ 7
	7.3 V				8.3V	7.3V		+12

duction indicating very definite dilution. This dilution was in contrast to its absence while under the influence of the drug. Thus in dog 12 bled on January 11, 1935, there was practically no change (Chart II) during 9 hours. The next day at 8:00 a. m. he was awake and active. A blood count at this time revealed 6,730,000 red cells or a reduction of 11% from his normal level. By 2:00 p. m. of the same day it had gone down further to 5,570,000 cells or a reduction of 25%. During this time no fluid or food was ingested. Similarly, dog 9 was bled November 27, 1934, with a resulting slight dilution of capillary and concentration of venous blood (Chart II) during 8 hours. The next day recovery from the anesthesia was complete and the capillary count was 4,680,000, the venous 4,520,000, a dilution of 20 and 22% respectively. Dog 13, also under amytal, was bled on January 15, 1935, and revealed a change even sooner. Thus for 5 hours there was a slight concentration of the blood (Chart II). The animal awoke from the anesthesia shortly afterward, although he was kept in the same position for 2 more hours. During these 2 hours the capillary count dropped to 6,990,000, a reduction of 6%, and the venous count to 6,780,000, a reduction of 8%. The next day, however, the capillary count was 6,250,000 or a reduction of 16%.

Conclusions. There is an immediate dilution of capillary and venous blood in the dog after a single large hemorrhage performed under local anesthesia. This dilution is absent when a similar hemorrhage is performed after the induction of intravenous sodium amytal anesthesia. There may even be a concentration of the blood under this circumstance. As soon as the effects of the anesthesia wear off dilution promptly appears.