

## THE DOSE OF SODIUM BARBITONE IN ANIMAL ANAESTHESIA

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Sodium Barbitone has been used to produce surgical anaesthesia in experimental animals, cats and dogs, intravenously.

The advantages claimed for it are :—

(1) Induction of anaesthesia after intravenous injection is fairly quick and when given fairly rapidly the different stages of anaesthesia, as present with volatile anaesthetics are not present, the animal falls suddenly asleep and unconscious. It causes irregularly descending depression of the central nervous system. Cerebral cortex and reticular activating system are the most sensitive, spinal cord less so, the vital medullary centres are the least sensitive (Goodman and Gilman 1956). Surgical anaesthesia is characterized by diminution or disappearance of superficial and deep reflexes, pupils are constricted and eyes are fixed, muscular tone is diminished, gastro-intestinal reflexes are not so depressed. Corneal reflex may not be abolished (Sollman, 1949). There is no salivation which is usual in ether anaesthesia.

(2) Disadvantages are :—

- (i) It causes prolonged narcosis and is not advised for survival experiments.
- (ii) It depresses respiration and circulation but not to the extent caused by ether.
- (iii) Individual response to a fixed dose is considerably variable.

The usual dose recommended varies from 0.225 g/Kg. (Sollman et al, 1928) to 0.3 g/kg. (Van Liere et al, 1952). While investigating the rate of absorption of glucose from the different regions of the gastro-intestinal tract it was found that even the lower recommended dose of 0.225 g/kg. I. V., was very often toxic leading to great depression of circulation and respiration, not infrequently ending in death of the animal,

Experiments were done to find the safe effective anaesthetic dose of the drug. The results of this investigation are reported in this paper.

#### METHODS AND MATERIALS.

Healthy adult dogs, male and female, of weights varying from 5 to 16 kg. as supplied by the municipal authorities were taken for experiments. They were kept under observation in the laboratory for 48 to 72 hours before being used.

On the day of the experiment the dogs were not given any food. They were lightly anaesthetized with ether, not more than one ounce was needed. No other premedication was given. The right femoral vein was exposed and cannulated, the vein was ligatured distal to the site of cannulization.

It was connected to a burette of normal saline with a rubber tube. Sodium barbiturate in 10% solution was introduced through the rubber tube connecting the burette with the cannula. Not more than 100 mg./kg. of the Barbiturate soln. ( $\equiv$  1ml/kg.) was injected in about 5 min. Five minutes after, if needed; as judged by the impairment of corneal reflex and the effect of cutaneous stimulation, further quantities, increasing by about 0.5 ml/kg. ( $\equiv$  50 mg/kg.) were given slowly in 5 minutes. After adequate dose anaesthesia was complete usually within 5 to 10 minutes after the cessation of the intravenous infusion.

The total number of animals used in the investigation were 41 of which 22 were males and 19 were females. The weights of the male animals varied from 8 to 16.5 kg. and of the female varied from 5.5 kg. to 15.5 kg. The maximum dose of the barbiturate needed was 320 mg/kg and the minimum was 90 mg/kg.

The results are tabulated in table I and II.

TABLE I.

Anaesthetic dose of Sodium Barbitone in male dogs.

Serial No.	Weight in kg.	Dose in mg/kg.	Remarks.
5	10.8	166	Anaesthesia satisfactory no unusual depression of B. P. and Respiration.
7	14	178	"
8	13.75	218	"
9	10.5	90	"
14	14	178	"
15	12	142	"
17	14	107	"
18	10	100	"
20	11	127	"
22	15	133	"
24	8	125	"
26	9.5	179	"
29	8.5	129	"
32	13	308	"
33	13.5	267	"
36	15	133	"
39	15	167	"
41	14.5	138	"
43	11.25	311	"
48	13.5	193	"
49	11	145	"
58	16.5	145	"

Mean — 167 mg/kg approximately.

S. D.—60.8 mg/kg approximately.

TABLE II.

Anaesthetic dose of Sodium Barbitone in female dogs.

Serial No.	Weight in kg.	Dose in mg./kg.	Remarks.
4	8.8	193	Anaesthesia satisfactory no unusual depression of B. P. and Respiration.
6	9.8	204	"
10	9.0	278	"
11	6.5	185	"
12	11.5	113	"
16	5.5	107	"
21	9.5	147	"
25	10.5	314	"
27	12.5	160	"
28	12.5	320	"
31	7	136	"
30	11	150	"
34	12	125	"
35	6	133	"
37	12.5	200	"
38	15.5	161	"
42	14.5	172	"
46	8.5	176	"
47	8.5	176	"

Mean — 192 mg/kg approximately.

S. D. — 61 mg/kg approximately.

The dose in female dogs is obviously higher than that in the male dogs, statistically it is not significant. The mean of the whole series both male and female is 174 mg/kg.

The standard deviation is  $\pm 60.69$  or 60.7 mg. approximately.

The standard error is  $\pm 9.5$  approximately.

## DISCUSSION

The effective dose per kg. of sodium barbitone I. V. to produce surgical anaesthesia in healthy adult mongrel dogs of North India shows wide variation from animal to animal. The mean anaesthetic dose is 174 mg./kg. 60.7 mg. approximately. No significant sexual variation has been found.

The dose found is much less than the dose (300 mg/kg) used by Van Liere et al and is also significantly less than the dose (225 mg/kg) suggested by Sollman et al (1928). It need not be stressed that the doses suggested by these authors are average doses which will be too toxic for some animals and inadequate for other animals. This will explain the incidence of death and inadequate anaesthesia if the recommended dose is injected invariably in a single dose. If anaesthesia is incomplete further quantities may be infused to ensure adequate anaesthesia. However it is also well known that the narcotic effect of barbiturate is more intense and prolonged if the same quantity is given as a single dose than when given in divided doses (Sollman 1949). But when over-depression has been induced by the initial single fixed dose, very little can be done to bring the animal back to the useful stage of surgical anaesthesia: analeptics may lighten the anaesthesia but it is likely to interfere with subsequent physiological and also pharmacological observations.

Moreover these doses recommended by Van Liere and Sollman as a result of experiments on dogs in America are too toxic for the majority of the North Indian dogs: only six animals out of total fortyone required a dose over 225 mg./kg. recommended by Sollman and only three animals required a dose over 300 mg/kg. recommended by Van Liere. Most animals were effectively anaesthetized with doses less than 225 mg/kg recommended by Sollman. Van Liere's technique was similar to the technique used in these experiments: they exposed the femoral vein under light ether anaesthesia, and injected the drug into the exposed vein.

Preliminary light ether anaesthesia, which was discontinued as soon as the femoral vein was exposed, is not likely to cause significant reduction of the effective dose of barbitone. At any rate Van Liere et al (1952) who used the same technique required 300 mg/kg for their dogs. There is obviously a variation of response to the barbiturate in these two types of dogs—Indian and American: the former type is more susceptible. Not unlikely this may be correlated with the state of nutrition of the two types of dogs. The local dogs as supplied by the municipal authorities are mostly vagabond dogs living on the refuse food of the people who themselves are not on a very liberal ration, with occasional helpings which they may secure by hunting rats and birds etc. In contrast the dogs used in American are usually supplied by breeders who carefully look after the dogs they supply.

## SUMMARY

(1) The dose of Sodium barbitone given intravenously to produce surgical anaesthesia in dogs as recommended by American authors was found to be too toxic for north Indian dogs.

(2) Fortyone adult healthy dogs, male and female, as supplied by municipal authorities (Jaipur and Lucknow) were experimented on to find the effective anaesthetic dose of Sodium Barbitone in Indian dogs. The drug was introduced into the femoral vein exposed under light ether anaesthesia. The initial dose used was 100 mg/kg. in 10% solution introduced in about five minutes. After waiting for further five minutes, if anaesthesia was not induced satisfactorily, further quantities not exceeding 50 mg./kg were introduced I. V. in five minutes. After adequate dose anaesthesia ensued usually within 5 to 10 minutes. Some dogs may require further injections. The mean dose found is 174 mg/kg., S. D.  $\pm$  60.7 mg. and the standard error is  $\pm$  9.5

(3) This is significantly lower than the doses recommended by the American workers. It is suggested that the increased susceptibility of Indian dogs is due to poorer nutritional condition of these dogs.

## CONCLUSION

(1) The anaesthetic dose of Sodium Barbitone I. V. in Indian dogs is 174 mg/kg. There is considerable individual variation (S. D.  $\pm$  61 mg/kg).

(2) As the effect of an overdose can not be prevented satisfactorily to ensure subsequent use of the animal for physiological investigation, it is advisable to start with an initial dose of 100 mg/kg. in 10% solution given I. V. in 5 minutes. If the anaesthesia is not adequate within 5 minutes after the cessation of the infusion, further quantities of the drug increasing by 50 mg/kg are given I. V. slowly in 5 minutes until perfect surgical anaesthesia is induced. Anaesthesia is induced usually within 5 to 19 minutes after an adequate dose.

(3) Dogs anaesthetised in this way show slight depression of blood pressure and respiration and remain in a condition of perfect and safe anaesthesia for more than 5 to 6 hours for any physiological investigations.

## REFERENCES

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