gated over a period of 18 months. With 25 mg. of dipipanone given by the deep subcutaneous or intramuscular route, adequate relief of pain in labour was achieved in over 90% of cases. Dipipanone was found to be a satisfactory adjunct to general anaesthesia. The dose initially required varied from 2.5 to 5 mg. according to the patient's age, weight, and physical condition. The total dose required for an operation of average duration was from 5 to 10 mg.

An alternative technique for the maintenance of controlled respiration during thoracotomy is presented, using dipipanone in place of muscle relaxants.

We wish to thank Mr. Kirwan Taylor for permission to conduct the trial of dipipanone in his maternity unit and to Sister Styles and her staff for their co-operation and help. We should also like to express our appreciation of the help we received from Sister Mathias, the senior theatre sister. We owe a special debt to Dr. G. Edwards for his encouragement and advice. "Pipadone" brand injection of dipipanone hydrochloride was kindly supplied by Burroughs Wellcome and Co.

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BUTHALITONE SODIUM IN OUT-PATIENT ANAESTHESIA

BY

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Buthalitone sodium, a short-acting thiobarbiturate, was first described by Miller *et al.* (1936). Following reports by Weese and Koss (1954) on its pharmacology and clinical use, it has been marketed as "transithal," "ulbreval," "baytenal," and thialbutone. Weese and Koss report on its use in 350 cases, both alone and combined with other anaesthetic agents. Similarly, Davidson and Love (1956) describe a series of 200 cases, the majority of which had buthalitone alone as a single dose. In both series an unspecified proportion of cases were out-patients, although in Davidson and Love's they constituted the largest group. Previously Nobes (1955b) had reported that if buthalitone is used for induction only and nitrous oxide and oxygen used for maintenance "a smooth and rapid recovery can be predicted far more confidently than with other intravenous agents used in the same way." No data were given in support of this statement, and the present paper describes an investigation into this technique of using buthalitone in 150 out-patients. Two other small series of cases are also included, illustrating the use of this drug in younger children and in out-patients where intubation was required.

Pharmacology

Buthalitone sodium is the sodium salt of 5-allyl-5-iso-butyl-2-thiobarbituric acid, having the formula:

Like other thiobarbiturates, it is a yellow powder readily soluble in water. However, the solution is readily decomposed by atmospheric carbon dioxide and must always be freshly prepared before use. In the preparation used (transithal), 6% by weight of anhydrous sodium carbonate had been added to inhibit this decomposition, the pH of the resulting 10% solution being about 10.5. This is approximately the same as that of a 5% solution of thiopentone. Therefore a 10% solution of buthalitone is probably as irritant to tissues as a 5% solution of thiopentone. This has, in fact, been demonstrated by Davidson and Love (1956), who record two instances of extraveneous injection. Similarly, intra-arterial injection would probably involve the same risk as that of thiopentone.

From their experiments with intravenous buthalitone in dogs, Weese and Koss (1954) report a transient and slight fall in blood pressure, but no cardiac irregularities were observed. The first sign of overdosage was depression of the respiratory centre. Detoxification was shown to take place in the liver, but a small proportion could be recovered from the urine.

Series A: Method of Investigation

This group comprised 150 out-patients aged 10 years and over, the oldest being 82 years. The average age was 31.1 years. These patients were unselected and the trial was conducted with a view to finding whether the use of buthalitone would prove more satisfactory in out-patient anaesthesia than existing inhalational techniques. The main requirements were avoidance of hypoxia during maintenance and rapid recovery from the anaesthetic in order to allow early ambulation. The need for an anaesthetic of this nature was accentuated by the fact that most of the patients were attending a special hand unit, where the surgical techniques employed demanded a longer operating time than is customary in most casualty departments. Another advantage would seem to be a more rapid and pleasant induction of anaesthesia for the patient.

The use of buthalitone alone in a single-dose technique was rejected because it was felt that, if sufficient dosage was to be given in order to ensure adequate anaesthesia to meet surgical requirements (up to 10 minutes in most cases), respiratory depression deep enough to require artificial respiration would be produced in many instances; buthalitone, like other thiobarbiturates, being only a hypnotic and not primarily an anaesthetic agent. Intermittent dosage of buthalitone was also rejected because it was considered that there would be a danger of prolonging the recovery time, as was in fact observed by Davidson and Love (1956). Therefore a single dose of buthalitone was followed by maintenance with nitrous oxide and oxygen. This method was adopted because it was felt that a more flexible anaesthesia would be produced which would satisfy our requirements as stated above.

Most of the patients were healthy young adults, but three had diabetes mellitus, two had chronic bronchitis, one had bronchiectasis, and one had well-compensated mitral stenosis.

Operations were performed for the following conditions: septic hands, 77 cases; other septic lesions, 25; removal of toenails, 13; manipulation of fractures, 21; miscellaneous, 14.

As can be seen from Table I, the majority of anaesthetics lasted between 5½ and 10 minutes; the average duration was 7.2 minutes, and the longest lasted 40 minutes.

TABLE I.—Duration of Anaesthesia

Time in Minutes	No. of Cases	Percentage of Total No. of Cases
Up to 5	55	36.66
5½ to 10	76	50.66
Over 10	19	12.66

All cases were premedicated with atropine, 1/100 gr. (0.65 mg.), half an hour before operation, as was the routine in this out-patient department. The reason for this was that there was always a possibility that the operation might prove to be a prolonged one and thus require the addition of trichlorethylene to the nitrous-oxide-oxygen mixture. This is in accord with the recommendation of Ostlere (1953) that when trichlorethylene is used "atropine or hyoscine premedication should always be given." The use of atropine was continued in this series, so that in comparing it with previous methods a possible variable factor could be eliminated. Nothing was allowed by mouth for four hours before operation.

A 10% solution of buthalitone was used. After trial in a few cases with varying dosages, it was found that an induction dose of 70 mg. per stone (11 mg. per kg.) body weight was the most suitable for our purposes. With larger doses recovery was delayed in most patients, while smaller doses produced insufficient basal narcosis, often requiring undue restraint of the patients.

All patients were therefore given a single induction dose at the rate of 70 mg. (0.7 ml.) per stone (11 mg. (0.11 ml.) per kg.) body weight, and anaesthesia was continued with nitrous oxide 8 litres a minute and oxygen 2 litres a minute. The injection was given rapidly and the patients fell asleep during or a few seconds after injection. They were particularly sensitive to extraneous noise during the induction period, and sudden noises were found to disturb them and often led to a stormy anaesthesia. This confirms the findings of Ruddell (1955), who emphasizes the need for quietness during induction. There were no instances of respiratory depression with this rate of dosage.

The following times were observed: "waking-time," "sitting-time," and "standing-time." These were recorded to the nearest half-minute and were measured from the conclusion of the anaesthesia. The waking-time was that at which the patient was awake and able to answer questions. Sitting-time was that at which the patient could sit up unaided; it corresponded to the time at which he or she could be assisted into a wheel-chair for removal from the casualty theatre. The standing-time was when the patient could stand unaided and was fit enough to leave for home. Although the patients were quite fit and mentally alert at the time of leaving, they were all sent home accompanied, travelling by car or ambulance.

Results

The results are shown in Table II. Approximately 90% of patients were awake by three minutes, able to sit by four minutes, and able to stand, and therefore be ready to leave for home, within 20 minutes of the cessation of the anaesthesia.

The trial was free from any serious complications. Slight movements occurred in 17 cases (11.3%), but they did not affect the operation in any way. In another 10 cases (6.6%) the movements were more marked, but with a moderate amount of restraint there was no interference with the operation. Retching occurred in 5 cases (3.3%) and vomiting whilst recovering consciousness in 9 (6%). Cough during induction was troublesome in 6 cases (4%) and hiccup occurred in 2 (1.3%), but disappeared quickly and spontaneously without special treatment. There was no instance of laryngeal spasm or of respiratory depression.

Series B: Use of Buthalitone in Children

Buthalitone has also been given to a group of 25 children (out-patients) aged from 6 to 9 years, using the same technique as described above. For these cases a smaller level of dosage was found to be adequate, and each child was given 50 mg. (0.5 ml.) per stone (8 mg. (0.08 ml.) per kg.) body weight. Anaesthesia was continued in the same way as with the adults and the same times were observed. The duration of anaesthesia varied from 4 to 39½ minutes, the average being 9.76 minutes.

The results, shown in Table III, demonstrate that this technique can be used in children when it is possible to give an intravenous injection. The results are similar to those obtained with adults, as can be seen by a comparison of the average times of waking, sitting, and standing in Tables II and III.

TABLE II.—Results in Adults

Waking-time			Sitting-time			Standing-time		
Time in Minutes	No. of Patients	% of Patients	Time in Minutes	No. of Patients	% of Patients	Time in Minutes	No. of Patients	% of Patients
0-1	48	32	0-1	36	24	0-1	6	4
1-2	37	24.6	1-2	56	37.3	2-3	20	13.3
2-3	20	13.3	2-3	27	18	4-5	22	14.6
3-4	18	12	3-4	13	8.6	5-6	12	8
4-5	5	3.3	4-5	8	5.3	6-7	18	12
5-6	7	4.6	5-6	5	3.3	7-8	14	9.3
6-7	4	2.6	6-7	2	1.3	8-9	9	6
7-8	3	2	7-8	—	—	9-10	13	8.6
8-9	1	0.6	8-9	—	—	10-11	11	7.3
9-10	4	2.6	9-10	—	—	11-12	13	8.6
10-11	—	—	10-11	1	0.6	12-13	3	2
11-12	—	—	11-12	—	—	13-14	1	0.6
12-13	—	—	12-13	—	—	14-15	4	2.6
13-14	—	—	13-14	—	—	15-16	1	0.6
14-15	—	—	14-15	1	0.6	16-17	—	—
15-16	—	—	15-16	—	—	17-18	1	0.6
16-17	—	—	16-17	—	—	18-19	—	—
17-18	—	—	17-18	—	—	19-20	—	—
18-19	—	—	18-19	—	—	20-21	—	—
19-20	1	0.6	19-20	—	—	21-22	—	—
Average, 1:57 minutes			Average, 2:58 minutes			Average, 11:43 minutes		

TABLE III.—Results in Children Aged 6 to 9 Years

Children 6-9	Limits in Minutes	Average in Minutes
Duration of anaesthesia	4-39½	9.76
Waking-time	½-4½	1.66
Sitting-time	1-5	2.60
Standing-time	2-20	8.18

Series C: Use of Buthalitone where Intubation is Required

Dietmann (1954) was the first worker to advocate the use of buthalitone with suxamethonium chloride for endotracheal intubation, and this combination has been tried on a group of 25 out-patients who, by nature of the surgical operation proposed, required intubation. Twenty-two cases required complicated dental extractions, and the other three the suturing of lacerations of the face and mouth. Their ages ranged from 10 to 57 years. The technique used was induction with buthalitone in similar dosage to that described in series A, immediately followed by suxamethonium chloride, 50 mg., and intubation. Maintenance was with nitrous oxide 6 litres a minute, oxygen 2 litres a minute, and trichlorethylene.

The recovery times (Table IV) are prolonged when compared with those in the other series. This is presumably due to the time required for the elimination of trichlorethylene by these patients.

TABLE IV.—Results in Series C

	Limits in Minutes	Average in Minutes
Duration of anaesthesia	5-35	14.54
Waking-time	½-12	2.94
Sitting-time	1-13	4.74
Standing-time	6½-56	21.32

Discussion

In most hospitals the routine method for out-patient anaesthesia is nitrous oxide and oxygen, either alone or with trichlorethylene. When nitrous oxide and oxygen are used alone it is not always easy to anaesthetize every patient, and often undesirable restraint has to be used to enable the operation to be performed, the patient remaining in the stage of analgesia throughout. Also, if the operation is prolonged for more than two or three minutes it may be difficult to avoid cyanosis and anoxia. These difficulties can be overcome if the nitrous oxide and oxygen are supplemented with trichlorethylene, but the recovery period is then often prolonged—a characteristic feature of trichlorethylene anaesthesia.

In the out-patient department where this work was carried out these problems were particularly acute because the surgical techniques employed often demanded a longer operating-time than is usual in most out-patient departments. This meant that the full recovery times were often prolonged, with consequent increased demands for post-operative supervision and space for recovery. Therefore, for these reasons and others given below, it was decided to try buthalitone for induction, followed by nitrous oxide and oxygen, in the hope that a more satisfactory anaesthesia could be obtained for the majority of patients.

Thiopentone was not chosen initially for the inducing agent, as, generally speaking, it has not found full acceptance as a suitable routine agent for out-patient anaesthesia, in spite of its use with other types of surgery for many years. Nobes (1955a) was the first in this country to suggest buthalitone as a suitable drug for out-patient anaesthesia because of its apparent shorter duration of action than thiopentone. It was this fact that led to buthalitone being adopted as an inducing agent when a new technique was being considered. The experience gained with buthalitone has led us to reconsider the position of thiopentone in out-patient anaesthesia. We have used the latter in equipotent dosage for a number of cases, but, as yet, our experience is not sufficient to justify a definite comparison between the two drugs. We hope to report on this in a subsequent paper.

On the basis of the results from our three series, totalling 200 cases, we consider that this method of out-patient anaesthesia is a satisfactory alternative to those involving inhalation anaesthesia alone, and, in fact, has some advantages over them.

For the anaesthetist, induction is smooth and rapid, and adequate oxygenation can be maintained throughout the anaesthetic. Satisfactory operating conditions are produced for the surgeon. The speedy recovery ensures that, in a busy out-patient department, the need to provide nursing supervision and space for recovery is lessened compared with that often required by more orthodox inhalation techniques when the operating-time is prolonged.

For the patient, induction is rapid and pleasant, and is usually preferred to methods involving the use of a mask. Recovery is also rapid, and the most striking feature is absence of post-anaesthetic drowsiness and confusion. This latter has been confirmed by spontaneous remarks from patients who have experienced other methods and from the casualty nursing staff, who report that there is less post-anaesthetic nausea and confusion after this method than when nitrous oxide and oxygen combined with trichlorethylene or thiopentone have been used.

Summary

A short review of buthalitone sodium and its use in out-patient anaesthesia is given.

Three series of cases totalling 200 are reviewed and a method of using it combined with nitrous oxide and oxygen is described. The view is put forward that this technique is a suitable method of anaesthesia for use in out-patient departments.

Reasons for suggesting that this technique has some advantages over inhalational methods of anaesthesia, especially when surgery is prolonged, are given.

We thank Professor W. W. Mushin, of the Department of Anaesthetics, Welsh National School of Medicine, Cardiff, for his help in the preparation of this paper.

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MITRAL VALVOTOMY DURING PREGNANCY

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Rheumatic valvular lesions constitute over 90% of all cases of organic heart disease complicating pregnancy (Hamilton, 1954). Predominant or pure mitral stenosis is by far the most common individual lesion. Pulmonary oedema resulting from mitral stenosis is the most important cardiac cause of death in pregnancy (Jones, 1951). It appeared to us that mitral valvotomy might diminish mortality from mitral stenosis complicated by pregnancy. Several reports of valvotomy performed during pregnancy have appeared (Brock, 1952; Cooley and Chapman, 1952; Logan and Turner, 1952; Mulcahy, 1954; Watt *et al.*, 1954; O'Connell and Mulcahy, 1955; Glover *et al.*, 1955; Bailey and Bolton, 1956). However, the published experience of each of these authors is limited.

Since 1950, 404 patients under the care of one of us (J. F. P.) have had mitral valvotomy; 274 were women of child-bearing age, and 18 of these had the operation performed during pregnancy. Our experience with these cases is summarized below.

Clinical Features

The clinical features are summarized in Table I. The majority of the patients had been supervised during their pregnancy at an antenatal clinic, but despite careful medical management had undergone rapid deterioration at various times between the 6th and 36th weeks of gestation.

The 12 multigravidae had suffered from dyspnoea requiring prolonged bed rest during one or more previous pregnancies. Only one of the primigravidae had significant disability before the onset of pregnancy, but dyspnoea was noted in each toward the end of the second month and increased rapidly in severity.

In each case the physical signs at the time of presentation indicated a diagnosis of pure mitral stenosis with severe pulmonary congestion or actual pulmonary oedema. The rhythm was regular; the first sound at the mitral area was slapping in quality and there was a rumbling mitral diastolic murmur with pre-systolic accentuation; an opening snap was usually heard; the pulmonary second sound was