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PETHIDINE IN LABOUR: RESULTS IN 500 CASES

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The search for the ideal analgesic agent for use in obstetrics has continued for very many years and innumerable agents have been recommended. Pethidine is a comparative newcomer to this field, and although it has already received extended trial its value, uses, and limitations do not seem to be as well known as they should be. This article embodies the results of its use in over 500 cases in the Obstetric Unit at University College Hospital between the years 1942 and 1946.

Chemistry and Pharmacology of Pethidine

Pethidine is 1-methyl-4-phenyl-piperidine-4-carboxylic acid ethyl ester hydrochloride. In Germany, where it was originally discovered, and in South America it is known as "dolantal" or "dolantin." In the U.S.A. and Canada it is known as "demerol," and it has also been known as S-140 and D-140. It is unfortunate that these different names have come into use in different countries, since it leads to confusion. The original description was given by Eisleb and Schaumann (1939), who introduced it as a synthetic substitute for atropine. They found that it not only possessed spasmolytic powers similar to those of atropine but also was antagonistic to acetylcholine, tended to depress the action of smooth muscle, and had a marked analgesic effect. Dietrich (1939) as a result of clinical trial found pethidine useful as an antispasmodic and analgesic.

Duguid and Heathcote (1940) found that pethidine has no haemolytic effect on erythrocytes and no effect on unicellular organisms. They noted a depression of all types of muscle—cardiac, striated, and non-striated. Pethidine also causes a non-toxic fall of blood pressure, depresses the respiratory centre, and acts as an analgesic by relieving spasm of smooth muscle and by raising the pain threshold. Gruber, Hart, and Gruber (1941) confirmed the fall in blood pressure, which they showed was due to preliminary vasodilatation. They found respiration temporarily diminished in depth and frequency, and that the effect on smooth muscle was unpredictable: no effect was noted on intact smooth muscle, contractions were maintained, and the analgesic effect was not due to spasmodolysis. Generally, the effect on the uterus was one of stimulation, though to a less degree than with posterior pituitary extract. Rothschild (1941) stated that pethidine is a powerful analgesic with an action like that of morphine. It stimulates rather than depresses the central nervous system. No effect was observed on the pulse or the pupils, but the fall of blood pressure was noted and also depression of respiration, though only with large doses. Batterman (1943) confirmed the above findings and stated that pethidine is more valuable for relieving pain of visceral origin than that of peripheral origin. He noted a tendency towards dizziness and faintness, and doubted if the drug was safe for ambulatory patients. Syncope was occasionally seen. Batterman and Himmelsbach (1943) studied the effects of pethidine and compared them with those of morphine. They tested the analgesic effect by raising the pain threshold, using the method

of Hardy, Wolff, and Goodell (1940). Batterman and Himmelsbach found that the pain threshold was raised to a maximum in one hour and that the effect lasted up to six hours. The usual duration of analgesia was about three hours. They found that 50 mg. of pethidine was equivalent to 22 mg. of codeine and to 17 mg. of morphine, but that the duration of its effect was shorter. They confirmed its value in visceral pain, especially in the colicky type, and quoted a personal communication from G. Woodby, who found no effect on the action of the uterus in labour. They considered the addiction liability less than that of morphine.

The question of the liability of pethidine to cause addiction was studied by Himmelsbach (1942), who stated that it was much less than with morphine. He observed tremor when pethidine was given over a long period. Andrews (1942a), using patients addicted to morphine, found that a tolerance is developed to the pain-threshold-raising effect that is maximal at eight weeks and is maintained for 30 days after discontinuance. Andrews (1942b) also found that morphine addiction causes changes in the electro-encephalogram and that pethidine in very large dosage has powerful cortical effects, which are pleasant and might lead to addiction. The doses given were enormous—in the region of 3,000 mg. Yonkman, Noth, and Hecht (1944) noted that pethidine is safe, is readily absorbed, and possesses a weak atropine-like action with a strong papaverine-like effect on smooth muscle. The effect was more intense in the presence of spasm or stimulation. Noth, Hecht, and Yonkman (1944) noted analgesic effects similar to those observed by Batterman and Himmelsbach (1943). They found a slight tendency to addiction.

Uses of Pethidine in Medicine, Surgery, and Gynaecology

Pethidine on account of its analgesic and spasmolytic effects has been used for relief of pain in medical, surgical, and gynaecological conditions. Christie (1943) gave pethidine by mouth to 335 cases, comparing its effect with that of tab. codein. co. He found that in 46% of cases pethidine was more effective than the codeine preparation, in 21% as effective, and in 33% it was ineffective. He found the analgesic effect less than that of morphine but generally enhanced when pethidine was given by injection. Branwood (1943) described clinical trials with pethidine, and concluded that it was valuable for biliary, renal, and intestinal colic and for hypertensive headaches. It was useless for neuritic pain. Sleep and drowsiness tended to occur independently of pain relief. A fall in blood pressure was noted, especially when pethidine was given intravenously, but no toxic effects were observed and no changes in blood or urine. FitzGerald and McArdle (1943) used pethidine in twelve neurological cases and found the effect comparable with or superior to that of morphine.

Objectionable side-effects such as giddiness, nausea, and faintness were noted when pethidine was given intravenously.

Rovenstein and Batterman (1943) described the use of pethidine with scopolamine for premedication. They found that patients tended to complain of thirst and dryness of the mouth. They noted, however, that this combination provides psychic sedation, does not depress respiration so much as morphine, facilitates induction of anaesthesia, has more effect in drying secretions than morphine, has fewer undesirable side-effects, and reduces the amount of anaesthesia required as much as morphine. Batterman and Mulholland (1943) studied the effect of pethidine as a substitute for morphine for post-operative pain. They found it satisfactory, though side-effects such as dizziness and nausea were noted. These might partly be due to the anaesthetic. The action was short—only about two hours. They prefer pethidine to morphine since it rarely causes respiratory depression, has an antispasmodic effect, dries mucous secretions, and does not suppress the cough reflex.

Sostmann (1940) used pethidine as a substitute for morphine in gynaecology. He found that the minimum effective dose was 25 mg. by mouth, 50 mg. by injection, and 100 mg. per rectum. He observed a good analgesic and spasmolytic effect. Hecht, Noth, and Yonkman (1943) studied the general effects of pethidine in 111 patients. They noted certain toxic effects, including dizziness, nausea, vomiting, dryness of the mouth, and euphoria. They found no effect with normal dosage on the blood or electroencephalogram, and concluded that pethidine can be used as a substitute for morphine. Hori and Gold (1944) reported a good effect from the use of pethidine in 2,000 cases, though this was weaker and of shorter duration than that of morphine. In post-operative cases there was less need for catheterization and the constipating effect was less than when morphine was used. Pethidine can be combined with scopolamine and with the barbiturates. In 50 obstetrical cases good sedation was obtained in 30, but the effect was better when pethidine was given with scopolamine.

Pethidine in Obstetrics

The first account of the use of pethidine in labour was that of Benthin (1940), who described its use in 400 cases. Pethidine was given alone in 250 cases and combined with amidopyrine in 150. The optimum dose was found to be 100 mg. given by intramuscular injection and repeated once or twice if necessary. The course of labour was uninfluenced and the child was not affected. The same author (Benthin, 1942) recommended an initial dose of 100 mg. combined with rectal administration. He claimed that pethidine reduced the duration of labour in 30- to 40-year-old primiparae to 13½ hours. He found that pethidine could usefully be combined with oxytocics such as "thymophysin." Sonnek (1941) stated that labour was facilitated by the use of pethidine, and Fuchs (1941) claimed good results from the use of twilight sleep induced by pethidine and an intravenous barbiturate.

Gilbert and Dixon (1943) administered pethidine to 150 women in labour. The drug was given alone to 54 primiparae, the highest dose used being 650 mg. and the lowest 100 mg. The average total dose was 294 mg. The average time elapsing between the last dose of pethidine and the end of labour was 2 hours 42 minutes, and the average total length of labour 11 hours 18 minutes. In 62 primiparae pethidine was used in combination with "seconal" (sodium propyl-methyl-carbonyl allyl barbiturate). The average duration of labour and the length after the final dose were similar to those in cases where pethidine was

given alone, and 72% of patients gained satisfactory analgesia with pethidine alone, though in no case was there amnesia. When pethidine was combined with "seconal" satisfactory amnesia could be obtained only with large doses—4½ gr. (0.29 g.) or more—of seconal. Toxic effects in the mother included dizziness and lightheadedness, also thirst and dryness of the mouth when a general anaesthetic was given as well. No effect on the third stage of labour was noted. Pethidine given alone had no apparent effect on the baby, but when combined with other methods, especially barbiturates, a slight to moderate depressant effect was noted, and treatment for foetal apnoea was necessary, though there were no foetal deaths from this cause. Gilbert and Dixon suggest as a programme for the conduct of labour that three 100-mg. doses should be given in the early stages and that the pethidine dosage should be completed early in labour. Amnesia may be added with other drugs when necessary.

Roby and Schumann (1943) presented a preliminary report of the use of pethidine combined with scopolamine in labour in 112 cases. They gave an initial dose of 100 mg. of pethidine, with 1/100 gr. (0.65 mg.) of scopolamine, followed by 1/100 gr. of scopolamine one hour later. Schumann (1944) gave a further report on 1,000 cases. These authors claim satisfactory amnesia in 70.5% and a shortening of labour by 2½ hours in primiparae and 1½ hours in multiparae. In patients expected to deliver themselves quickly, intravenous administration was used with no demonstrable ill effect, except for transient nausea. Of 37 patients delivered without anaesthesia 79% could recall no pain whatever. No demonstrable effect was noted on full-time or premature babies. Schumann claims that pethidine combined with scopolamine is superior as an obstetric analgesic to others in common use.

The following scheme of dosage is recommended. An initial dose of 100 mg. of pethidine and 1/100 gr. (0.65 mg.) of scopolamine is given. Forty-five minutes later a further 1/150 gr. (0.43 mg.) of scopolamine is given, and 100 mg. of pethidine with 1/200 gr. (0.32 mg.) of scopolamine four hours later. This is followed as required by 100 mg. of pethidine every four hours and 1/200 gr. of scopolamine every three hours. Mackenzie (1943) described two cases in which 50 mg. of pethidine hastened dilatation and relieved distress in the course of prolonged labour.

Gallen and Prescott (1944) described clinical studies in 150 cases. They gave 200 mg. of pethidine alone or in combination with scopolamine or with a bromide-chloral-and-opium mixture ("mother's mist"). They found that pethidine acts in 15 minutes and the effect lasts three to four hours. Amnesia was noted in only one case where morphine and scopolamine were also given. The duration of labour was apparently prolonged, but the forceps rate was 10%—not a significant increase. Toxic reactions included vomiting, rise of blood pressure, dizziness, vertigo, and dryness of the throat, but the pethidine was given by the intravenous route. Nine babies required resuscitation, and these authors doubt whether pethidine should be given within 2½ hours before delivery is expected.

Cripps, Hall, and Haultain (1944) in a report of 102 cases concluded that although pethidine is not the ideal obstetrical analgesic it fulfils many of the conditions required of such an agent. It is not always successful in producing analgesia, but no undue excitability was noted. Amnesia occurred only when hyoscine (scopolamine) was given as well. Pethidine was found useful for premedication for caesarean section under local analgesia in six cases. Spitzer (1944) described a series of 80 normal mothers in whom all but 10% received satisfactory relief

of pain in labour with pethidine. The oral route was used and doses of 50 mg. initially, followed by 25 mg., were given. No side-effects were observed. Spitzer claims, though without statistical evidence, that pethidine has a remarkable shortening effect on normal labour. Venters (1944) described a routine for labour where a bromide-and-chloral mixture was combined with diamorphine ("heroin"). Recently good results had been obtained by substituting pethidine for heroin, either entirely or in part.

Steinberg (1945), in describing 400 cases where pethidine and scopolamine had been used in labour, noted three cases in which oedema of the uvula occurred, one having oedema of the glottis as well. All three exhibited a cutaneous sensitivity to scopolamine, as did a fourth case in which oedema of the uvula occurred after the use of seconal and scopolamine. While not completely relevant to the discussion of pethidine in labour, this represents a complication of the use of scopolamine that might well prove dangerous.

Lull and Hingson (1945) describe pethidine as one of the safer drugs for obstetric analgesia, though they believe that depression of foetal respiration occurs comparable to that present in the mother. Less narcotization of the baby is seen than with morphine. They recommend the combination of pethidine with scopolamine or barbiturates.

It will be seen from the review of the uses of pethidine that it promises well as an obstetric analgesic, though it does not gain universal or unqualified approval. Its chief advantage seems to lie in its relative safety to mother and child and in the relative rarity of toxic effects. It certainly deserves extended trial, and the object of this paper is to present results in such a trial, to assess its scope and limitations in obstetrics, and to make recommendations for its use in the future.

Clinical Results

Pethidine was first used for obstetric cases in the Obstetric Unit at University College Hospital in 1942. In order to establish the safety of this then relatively new drug a preliminary trial was carried out in 47 cases using doses of 50 mg. No toxic effects were noted, but it seemed that this dosage was inadequate.

Between 1942 and 1946 a full trial was given in 500 labours. Pethidine was not administered to every patient in labour, but only to those who appeared to require a sedative or analgesic. These cases are thus to some extent selected, since patients who had easy and relatively painless labours did not receive pethidine. The dose used was 100 mg. given by subcutaneous or intramuscular injection, and repeated as required. In many cases pethidine was combined with other sedatives and analgesics, patients receiving nitrous-oxide-and-air analgesia or "trilene" in the later stages of labour. In a few cases where pethidine appeared to be insufficient, morphine or papaveretum ("omnupon") was given later in labour. No case received hyoscine since it was desired to ascertain as far as possible the effects of pethidine alone.

This series of 500 cases included eight pairs of twins, so that 500 mothers gave birth to 508 infants. There were 479 primigravidae and 21 multiparae. The total dosage given was as follows:

344 mothers received 100 mg.	9 mothers received 400 mg.
124 " " 200 "	2 " " 500 "
1 mother " 250 "	1 mother " 600 "
19 mothers " 300 "	

A single injection of 100 mg. was adequate for the majority of labours, and a high proportion of the remainder required only two doses. Table I shows the method of delivery in these 500 cases.

TABLE I.—*Method of Delivery*

	Primigravidae	Multiparae
Spontaneous, vertex presentation ..	415	20
Forceps	46	0
Breech presentation	8	0
Face presentation	3	0
Twins	7	1
Total	479	21

There was no maternal mortality. Slight toxic effects were noted in eleven mothers. These included dizziness, a feeling of faintness, giddiness, or numbness, sweating, and slight retching. One mother stated that the injection made her feel "fighting mad." These effects were transient.

Of the 508 babies 21 were lost: 8 were stillborn and 8 macerated—a stillbirth rate of 16 (3.2%)—and there were 5 (1%) neonatal deaths, making a total loss of infant life of 4.2%. Of the 8 stillbirths, two followed forceps delivery, two breech delivery, two were found to have atelectasis at necropsy, but both had died *in utero* before pethidine was given. One infant had a bilocular heart and the eighth was a premature twin weighing only 2 lb. 6 oz. (1.1 kg.). Five of the macerated infants died in labour for no apparent cause, and the remaining three consisted of one pair of twins and a premature twin infant. Two of the neonatal deaths were due to gross deformity, one to asphyxia following forceps delivery, one to prematurity, and one to white asphyxia following a very long labour. It was not felt that the administration of pethidine contributed in any way to the infant deaths.

Signs of asphyxia at birth were noted in 55 infants. Of these, 13 were born in a state of white asphyxia or shock, but in all except one there was a definite cause such as operative delivery. Of the rest, the type of asphyxia was not stated in three cases, and in 39 the infant was slightly blue at birth or slow to breathe.

The mean time elapsing between the last dose of pethidine and delivery in the 500 cases was 6.74 hours. It was found, however, that 143 mothers were delivered less than three hours after the last dose, 51 three to four hours after the last dose, and 56 four to five hours after the last dose. In the cases of the mothers of the 55 babies suffering from asphyxia it was found that 13 were delivered less than three hours after the last dose, 4 three to four hours after, and 2 four to five hours after. In view of these findings it seems doubtful if pethidine contributed to foetal asphyxia to any serious extent, though in a few cases it may have caused slight respiratory depression.

The effect of pethidine on the mother in labour was studied in the following ways. Those responsible for the conduct of labour were asked to observe and report the analgesic and amnesic effects of pethidine, and, in addition, patients were asked, either shortly after delivery or on the following day, to express an opinion on the relief of pain and the sedative effect given by the injections. Satisfactory answers were not obtained in all cases, since the memory of labour is often blurred by natural amnesia or by the effect of other analgesics such as nitrous oxide or trilene or by a general anaesthetic given for instrumental delivery. The results are summarized in Tables II, III, and IV under the headings analgesia, amnesia, and patients' opinion.

TABLE II.—*Analgesic Effect of Pethidine in Labour*

Complete analgesia	26
Good analgesia	208
Slight relief of pain	84
No relief	110
Not stated	72
Total	500

Thus out of 428 patients satisfactory analgesia was obtained in 234 (55%). Some analgesia was obtained in 318, or 74% of these 428 cases. In many of the cases in which there was no relief the injection was given much too late in labour—towards the end of the first stage, when it was found that pethidine was often ineffective and that inhalational analgesia as by nitrous oxide and trileine was to be preferred.

TABLE III.—*Amnesic Effect of Pethidine in Labour*

Good or complete amnesia	21
Slight amnesia	13
No amnesia	304
Not stated	162
Total	500

Thus out of 338 patients only 34 (10%) obtained any amnesic effect. This confirms the findings by others that pethidine has little such action when given alone. If amnesia is required, some other drug such as hyoscine must be added.

TABLE IV.—*Patients' Opinion of Pethidine in Labour*

Very enthusiastic, complete relief of all symptoms	30
Good relief of pain	103
Slight relief of pain	18
Slept after injections	126
Able to rest well after injections	96
Able to relax after injections	35
Relieved nervousness	5
Appeared to hasten labour	23
Doubtful	62
No effect	62
Total	500

These results were summed up under the above heading as representing most adequately the statements made by patients when questioned regarding the effects of pethidine. The answers appear to fall into two main groups—those who claimed relief of pain and those who experienced a sedative effect, permitting sleep in many, and in others inducing a feeling of restfulness and relaxation. Out of the 477 patients who gave satisfactory answers, 415 (87%) had had some relief of symptoms following the administration of pethidine. Several patients stated that they found the effect of pethidine of short duration.

The effect of pethidine on the course of labour was studied by noting the action of the injection on the uterine contractions. No effect was noted in 334 cases, or 67%. In 118 (23.3%) the strength of the contractions seemed to be increased and the course of labour hastened, while in 44 (8.8%) the contractions appeared to diminish in strength. No record was available in four cases.

It has been claimed that pethidine reduces the duration of labour, and it was decided to investigate this point by determining the length of labour in this series and in a control series in which no pethidine was given. For control purposes the duration of labour in primigravidae delivered in the Obstetric Hospital, University College Hospital, in the year 1939 was estimated. This year was chosen because 1940 and 1941 were abnormal years, and pethidine has been consistently in use in the hospital since 1942. The results are given in Table V, which shows the mean duration of

TABLE V.—*Effect of Pethidine on the Duration of Labour in Primigravidae*

	Total	1st Stage (hrs.)		2nd Stage (mins.)		3rd Stage (mins.)	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
Pethidine	476	29.5	22.0	118.1	117.0	31.2	27.1
Controls	619	22.2	21.2	113.3	90.5	27.0	34.5
Difference		7.3		4.8		4.2	
Standard error of difference		1.3		6.5		1.9	

the first, second, and third stages of labour in 476 out of the 479 primigravidae who received pethidine compared with those in 619 primigravidae delivered in the hospital in 1939.

It will be seen that the patients who received pethidine had a significantly longer first stage than the controls, while there is an apparent prolongation of the second stage which is not significant and is of less than five minutes. The difference in the duration of the third stage is also slight and barely statistically significant. It is fully realized that the pethidine cases were specially selected on account of distress in labour, and form only a portion of the patients delivered in the hospital between 1942 and 1946, so that this is by no means an adequately controlled series. Ideally, of course, for the purpose of such a series, pethidine should be given to alternate primigravidae in labour, but there are many practical difficulties in the way of such an experiment, including the fact that not infrequently patients arrive in the hospital very late in the course of labour and often in the second stage. These results do not, however, support the claims that pethidine reduces the duration of labour.

Forceps delivery was performed in 46 out of the 500 patients who received pethidine in labour. This gives a forceps rate of 9.2%. During the year 1939, 927 patients were delivered in the hospital, 22 by caesarean section. Of the 905 patients delivered per vaginam forceps delivery was performed in 71—a forceps rate of 7.8%. The difference between the two groups is not statistically significant, and in any event the higher proportion of primigravidae in the cases receiving pethidine probably accounts for the slightly higher rate of forceps delivery.

Post-partum haemorrhage—a loss of blood exceeding 20 fl. oz. (568 ml.) after the birth of the baby—was noted in 16 of the 500 cases receiving pethidine. In six cases haemorrhage followed forceps delivery, in one case extraction of the breech was performed under anaesthesia, and there was one case of twins. No cause was apparent in the remaining eight cases. This low incidence suggests that pethidine given in labour does not in any way cause an increased tendency to haemorrhage in the third stage.

As was stated earlier, many of the patients in this series received some other analgesic or sedative in addition to pethidine. It was found that pethidine could be effectively combined with chloral hydrate, 2 fl. dr. (7 ml.) (22 gr. (1.5 g.) of chloral hydrate) being given by mouth 20 minutes after the injection of pethidine. For the later part of the first stage and for the second stage, nitrous oxide or trileine analgesia was given in many instances. For forceps delivery general anaesthesia was always used.

Pethidine as Premedication for Caesarean Section

Because pethidine appears to produce little or no depression of the foetal respiratory system, even when given shortly before delivery, it has been used for premedication in cases of caesarean section. Records of 32 operations are available for the present series. Pethidine was given in combination with atropine gr. 1/100 (0.65 mg.), four patients receiving 100 mg., 27 receiving 200 mg., and one, to whom 500 mg. of pethidine had previously been given in labour, a total of 600 mg. There was no maternal or foetal mortality. Slight asphyxia was noted in 10 infants, but in eight delivery had been performed under general anaesthesia. In one case epidural analgesia combined with nitrous oxide was used, while delivery in another was accomplished with local analgesia. In this last case there was a slight depression of respiration, but recovery was rapid.

General anaesthesia was employed in 17 cases. Epidural analgesia was used alone in six cases and supplemented by nitrous oxide and oxygen in seven. One patient was delivered under local analgesia and one under local analgesia supplemented by cyclopropane. The high proportion

of cases of epidural analgesia is accounted for by the fact that this method was under trial in the hospital while the investigation of pethidine was taking place. Six of the infants were premature, weighing from 3 lb. 1 oz. (1.4 kg.) to 5 lb. 8 oz. (2.5 kg.). In none was there any sign of asphyxia.

This small series is included because it gives evidence regarding the effect of pethidine on the infant. In almost every case the second dose of 100 mg. of pethidine was given well within an hour preceding the operation. In only one case could any effect on the foetal respiratory system from pethidine alone be noted, and this was slight and transient. In the cases receiving general anaesthesia it is difficult to assign responsibility for foetal asphyxia. The effect on the mother is not easy to assess, especially as so many received general anaesthesia. The impression was gained that a more useful effect would be obtained by combining pethidine with hyoscine as premedication for caesarean section, though a series of cases would be necessary to prove the safety of this.

Conclusions

Six criteria for the ideal method of relieving pain in labour were laid down by Sturrock (1939). As a result of the experience in 500 cases it is now proposed to attempt to assess how far pethidine fulfils his conditions.

1. "That it does not endanger the life of the mother or child or in any way have an adverse effect upon them."—Pethidine appears to satisfy the first part of this criterion. In the present series there was no maternal mortality. The foetal mortality was low and in no case could foetal death be attributed to pethidine. Toxic effects noted in the mother were slight and transient, amounting to little more than dizziness or a feeling of faintness. It has been stated that pethidine has a slight but definite depressant effect on the foetal respiratory system. In the present series pethidine may have accounted for a few of the cases of slight asphyxia or of slowness in achieving normal respiration. The condition was never severe enough to cause anxiety and recovery was always rapid.

2. "That it abolishes or diminishes pain and the memory of suffering over long periods."—Good analgesia was obtained in the present series in 55% of cases, while 74% of patients obtained some relief of pain. In some of the cases where pethidine failed to procure analgesia it is suggested that the injection may have been given too late in labour. In addition, a definite sedative effect was claimed by a large number of patients, so that 87% experienced relief of symptoms in some form. It does seem possible that there is some personal idiosyncrasy to pethidine. This is noted when pethidine is given in medical, surgical, and gynaecological cases, some patients obtaining marked relief while in others there is little or none. Pethidine has little or no amnesic effect, and if amnesia is required in labour it is suggested that hyoscine be given in addition, though it is doubtful whether complete amnesia is either essential or desirable in every labour. Sturrock's second criterion is thus only partly fulfilled by pethidine.

3. "That it does not diminish uterine contractions and thereby delay labour or predispose to atonic post-partum haemorrhage."—In 67% of cases no effect was noted on uterine contractions, in 23.3% the contractions appeared to increase, and in 8.8% there seemed to be a slight diminution. The first stage of labour lasted longer in the primigravidae receiving pethidine than in a control series of primigravidae delivered in 1939; but there is a probable fallacy in this observation, since the cases receiving pethidine were selected on account of difficulty or distress in labour. No tendency to post-partum haemorrhage was noted.

4. "That during the second stage it does not prevent the patient from co-operating intelligently with the doctor, so that an antiseptic and aseptic technique can be maintained."—This condition is amply fulfilled when pethidine alone is used, as the slight effects of pethidine on the patient do not prevent co-operation.

5. "That there is no necessity for operative delivery solely on account of the method used to alleviate pain."—This condition is also fulfilled, since there was no evidence of an increase in the number of patients requiring forceps delivery after pethidine.

6. "That it is simple to give."—This criterion is easily fulfilled, as a single injection of 100 mg. of pethidine appears to suffice for the majority of labours, though some require a second injection and a few three or more. The method of administration, however, presents no practical difficulties.

It may be concluded that pethidine approaches the criteria for an ideal analgesic for use in labour more nearly than any other known substance. Its chief advantages are safety, lack of toxic effects, lack of effect on the course of labour, and simplicity of administration. It may also usefully be combined with other agents. Hyoscine has not been employed in this series, but reports of its use in combination with pethidine are encouraging. It would seem to give the advantage of amnesia, but with the possible disadvantage of lack of co-operation of the patient in the later stages of labour and thus of a possible increased need for instrumental delivery.

It is not suggested that pethidine is necessary in every labour. It is well known that many labours are relatively painless and that much can be done for the patient by encouragement, allaying nervousness, and by the practice of relaxation. These facts are well known and everything must be done to apply them. There are still many cases in which there is real distress. Pethidine helps such patients by allaying suffering and by inducing sleep or restfulness. It is suggested that 100 mg. of pethidine be given by injection as soon as the uterine contractions are causing distress. This dose may be repeated in one hour if necessary and thereafter as required. Chloral hydrate given in addition has appeared to enhance the effect. For the later stages inhalational analgesia in the form of nitrous oxide and air or oxygen or trileone may be used if necessary. This combination will give relief in the majority of cases and is simple and safe.

Summary

The results of the administration of pethidine in labour to 500 patients—479 primigravidae and 21 multiparae—are given.

There was no maternal mortality. Eleven mothers noted slight toxic symptoms.

The foetal mortality was 16 stillbirths (3.2%) and 5 neonatal deaths (1%). Signs of asphyxia were noted in 55 infants; recovery occurred in all. Pethidine may have contributed to slight respiratory depression in a few cases.

Good analgesia was experienced by 55% of mothers. Failures may be accounted for in some cases by the fact that pethidine was given too late in labour. Amnesia was obtained in only 10%. Pethidine given alone does not appear to lead to amnesia.

Some relief of symptoms, chiefly in the form of analgesia or of sleep, and a feeling of restfulness and relaxation were experienced by 87% of the patients.

No effect on uterine contractions was noted in 67%. In 23.3% contractions appeared to increase, while in 8.7% they appeared to diminish.

The duration of labour was compared in primigravidae with a control series of patients delivered in 1939. It was found that the first stage was seven hours longer in patients receiving pethidine. This may be due to other factors, but the claim that pethidine shortens the duration of labour cannot be substantiated.

The forceps rate was 9.2%, comparing favourably with a rate of 7.8% for the year 1939, since the series receiving pethidine contained a high proportion of primigravidae.

No tendency to post-partum haemorrhage was noted.

Pethidine was used for premedication for caesarean section in 32 cases. There was no maternal or foetal mortality.

As a result of this investigation pethidine is compared as an obstetric analgesic with the ideal criteria laid down for such an

agent by Sturrock (1939). Although pethidine does not fulfil all his criteria it is suggested that it approaches the ideal more nearly than any other obstetric analgesic drug in current use.

Brief recommendations for the use of pethidine in labour are given.

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AN OUTBREAK OF STAPHYLOCOCCAL FOOD-POISONING

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Since 1930 many outbreaks of food-poisoning have been described in which the evidence has pointed to a staphylococcus as the responsible organism. Commonly, milk and milk products have been the vehicle, but other foods, such as prepared meats, have less often been the medium in which the toxic substance was disseminated. The actual time and place when contamination of the food occurred have been difficult to define, and conclusions have been made on circumstantial evidence. Early last year Williams *et al.* (1946) described three outbreaks of staphylococcal food-poisoning due to ice-cream, in two of which, by typing the isolated staphylococci with bacteriophage, they were able to trace the source of contamination to an assistant in the cookhouse where the ice-cream was prepared.

The present article describes an outbreak of staphylococcal food-poisoning due to consumption of pressed pickled beef in which the source of infection was demonstrated by means of bacteriophage typing.

The Outbreak

On Sept. 27, 1946, 167 miners at several collieries were taken ill three hours after eating sandwiches containing pressed pickled beef. The outbreak was explosive, and clinically the onset was sudden, with dizziness, nausea, vomiting, diarrhoea, and pain in the abdomen. All the patients were much better in 24 hours and were normal in about three days. Fifteen men were sent to hospital with severe prostration, but were not detained longer than 24 hours.

This outbreak had been preceded by two smaller ones, on Aug. 16 and 30, involving 16 and 22 men respectively, pressed beef sandwiches being the suspected food. On the first occasion the cause was not established. On the second occasion a staphylococcus was isolated from the pressed pickled beef but not from the vomit. All the meat came from one cooking centre, but in the second outbreak this was not obvious, because the sandwiches had on this occasion been made up elsewhere. Immediately the third outbreak occurred steps were taken to investigate the matter in detail.

The Food.—At the centre from which the pressed beef was distributed the meat was cooked, pickled, and pressed by one butcher, who placed it, when ready for cutting, in a large refrigerator of the domestic type, operating at a temperature just above freezing point. The quality of the food and the conditions during preparation were quite satisfactory. The pressed beef was made into sandwiches on the day of distribution to the collieries. One pressed beef sandwich was wrapped in grease-proof paper along with another containing either roast beef or corned beef. The whole packet was known as a "B" pack, and had stamped on it a date after which the pack should not be eaten (this prevented the sale of stale sandwiches). These "B" packs arrived at the various collieries between 9 a.m. and 1 p.m. on the day of distribution, and were issued to the afternoon shifts at 2 p.m., to the night shifts at 10 p.m., and to the day shifts at 6 o'clock the following morning.

The scientists on the whaling factory ship *Balaena*, in the Antarctic, have been investigating for the Department of Scientific and Industrial Research methods of ensuring that whale meat is in the freshest possible condition when frozen. There are certain general principles of slaughtering of animals for meat and the handling of carcasses which can be followed only with difficulty in whaling. One of the most important of these is rapid cooling of the carcass immediately after death. Owing to the bulk of the whale's carcass and the thickness of the blubber cooling takes place very slowly, and the meat is therefore likely to go bad rapidly. As the time between death and butchering on the deck of the factory ship may vary considerably, some method of cooling the carcass as soon as possible after death had to be found. An experiment was recently carried out to test a method of doing this. The carcass of a whale when caught is normally inflated with air to prevent its sinking. This causes the whale to roll over on to its back and float belly uppermost. In the experiment portions of the skin and blubber were removed as soon as possible after death to admit cold sea water, which at that time was at a temperature of 30° F. (−1° C.). It was necessary to insert a special temperature-recording unit deep into the body before this to register the temperature immediately after death and any subsequent change. The leader of the scientific team, Dr. R. A. M. Case, therefore entered the water as the whale surfaced after its final dive. Clad in a frog-man diving suit he swam under the belly of the whale and shot his recording thermometer into it. It was found that when the blubber was stripped from the belly the internal temperature of the whale fell rapidly.