Solubility of Bullets, Pure Lead, and Antimonial Lead.

Time.	Solvent.	Pure Lead.	Antimonial Lead.
6 days (heated) ...	Neatsfoot oil (acidity 3.2) Olive oil (acidity 1.6)	Per Million. 200 300	Per Million. 200 200
4 days (cold) ...	Neatsfoot oil (acidity 3.2)	30	15
1½ days (heated) ...	Olive oil (acidity 1.6)	300	100

A piece of a lead bullet was placed in pus removed from a case of empyema. It was allowed to remain therein for forty-eight hours at a temperature of 40° C. On examination the pus was found to contain 12 parts of lead per million.

"The result of our experimental work shows that present-day hardened lead is soluble in the proportion of approximately three parts as against two and a half of pure lead in aqueous liquid, and that in fatty liquids or semi-liquids the pure lead is much the more soluble."

In addition to lead, shrapnel contains antimony and arsenic, and this raises the interesting question whether antimony and arsenic may not be absorbed as well as lead. It was common practice years ago in Germany, when horses were taken to market to be sold, for horse dealers to give to broken-winded animals a few ounces of small shot. This was followed by good effects which lasted for several days. The improved condition of the animals was attributed to the arsenic in the shot. We cannot, of course, compare the presence of shot in the alimentary canal of a horse with the retention of pieces of shrapnel in the lungs, the muscles, connective and adipose tissues of a wounded soldier. Apart from animal differences the metal in one instance is first exposed to an acid medium in the stomach, while in the other it is exposed to the alkaline juices of the tissues of the body, even allowing for the slightly acid reaction developed in actively contracting muscle. Experiments have been made in regard to this subject in Germany. Professor L. Lewin of Berlin, in a paper¹ on the toxic effects of arsenic in bullets, states that 10 grams of shrapnel containing 8 per cent. of antimony and 14 mg. of arsenic were broken up into numerous small pieces, placed in the undermentioned solvents in an Erlenmeyer's flask and kept at a temperature of 38° C. The results were as follows:

Experiment.	Solvent.	Duration in Days.	Solution in Percentage.		
			Lead.	Antimony.	Arsenic.
1	HCl 0.25 %	6	0.033	trace	trace
2	HCl 0.25 %	14	1.1	0.02	trace
3	Olive oil	6	0.628	trace	trace
4	Olive oil	14	2.0	0.57	trace

From these experiments we learn that more antimony than arsenic was dissolved, and that the amount of antimony dissolved was proportional to the length of exposure; also that, high as a solvent dilute hydrochloric acid may be for lead, olive oil is even higher. Lewin submitted similar pieces of shrapnel to the action of weak alkaline solutions—for example, 0.05 per cent. to 0.2 per cent. of soda—but, even after fourteen days' exposure, the amounts of antimony varied from 0.007 to 0.013 mg., while the amount of arsenic remained at 0.0002. From these experiments we may take it that, so far as the retention of shrapnel in the body is concerned, no damage is to be apprehended from arsenic and antimony. The one danger is lead.

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NOTES ON PAINLESS CHILDBIRTH.

(HYOSCINE (SCOPOLAMINE) AND MORPHINE.)

BY

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ALTHOUGH several papers have been published in this country on the satisfactory and safe use of scopolamine and morphine in labour, further records appear desirable. An account of those cases in a consecutive series which illustrate the chief points will be more useful than an abstract treatise. I will therefore state the facts and give illustrations from a first series of 60 consecutive cases, 30 conducted in hospital, and 30 in private practice, most of the latter being in a nursing home. If the series were extended and the first cases excluded, I could show better results, but my chief object is to point out the pitfalls and possible dangers. The technique was modelled on that of Gauss of Freiburg.

Illustrative Cases.

The two following cases indicate the possibilities and technique:

CASE I.

Primipara, with a small round pelvis. In consultation it was decided that a normal delivery at term was possible.

The patient was awakened at 2 a.m. the day before term by sharp pains; although unable to sleep she did not send till 9 a.m. as subsequent pains were slight and at long intervals; there was not much suffering during the day, but at 9 p.m. the pains became severe. At 10 p.m. morphine $\frac{1}{4}$ gr. and hyoscine $\frac{1}{16}$ gr. were injected, the os then being the size of a two-shilling piece. The ears were plugged with cotton-wool soaked in oil, the room darkened, and the patient put on her side in bed. In twenty minutes she was sleeping quietly, and continued to do so till 1.35 a.m.; the fetal heart being satisfactory, at 1.45 a.m. hyoscine $\frac{1}{16}$ gr. was given, and a drink of water. At 5.30 a.m. the patient was again rousing; the membranes ruptured and the os was found to be fully dilated, so a third dose of hyoscine $\frac{1}{16}$ gr. was injected. At 8 a.m. a little chloroform was given by a colleague and the child delivered with forceps at 8.20 a.m. The patient did not wake till 10 a.m., when she found by feeling her abdomen that the baby was born. She said she felt no pain after the first injection.

CASE II.

Multipara. The patient was brought by her husband; she was not enthusiastic, looking on the treatment as an unnecessary fuss and expense.

Labour began at 2.30 p.m., when the os admitted two fingers; at 2.40 p.m. morphine $\frac{1}{4}$ gr. and hyoscine $\frac{1}{16}$ gr. were given; accessory treatment as usual. The patient lay on her side and went to sleep almost immediately; at 5.30 p.m. she moved for the first time, sat up in bed, and asked for a drink of water; she at once went to sleep again; at 6.45 p.m. the second dose (hyoscine $\frac{1}{16}$ gr.) was given; she was soon asleep, and the nurse thought all pains stopped; she woke up once and had another drink of water. The third dose (hyoscine $\frac{1}{16}$ gr.) was given at 11 p.m. She again went to sleep; fifty minutes later the nurse noticed her moving; she looked and found the head crowning, the baby being born before any one else could be summoned, the nurse describing it as being born with only one pain.

This patient (Case II) was subsequently most enthusiastic about the treatment. The case shows that the effect is not due to any psychological impression on the patient.

It must not be assumed that all cases will be so simple and satisfactory; occasionally the patient is restless; slight degrees can be dealt with by a few whiffs of chloroform; when severe the condition is due to faulty technique, either not giving the patient water to drink or excessive doses of hyoscine, as the following record shows.

CASE III.

Primipara. Pelvis contracted, the external measurements being: Interspinal, 9 in.; intercrural, 10 in.; external conjugate, 7 in.

Severe pains began at 4 a.m.; at 4.15 a.m. morphine $\frac{1}{4}$ gr. and hyoscine $\frac{1}{16}$ gr. were given. The patient was soon asleep. Doses of hyoscine $\frac{1}{16}$ gr. were given at 5.30 a.m., 9.30 a.m., and 12.15 p.m. At 4 p.m., as the patient was becoming conscious and there was no prospect of delivery for some hours, another dose of morphine $\frac{1}{4}$ gr. was given with hyoscine $\frac{1}{16}$ gr.; at 7.30, and again at 10.15 p.m., hyoscine $\frac{1}{16}$ gr. was given. I was then obliged to leave, so left a further dose of hyoscine $\frac{1}{16}$ gr. to be given if necessary. Shortly after the patient woke and became very restless. The nurse, thinking this was due to an insufficient dose, injected another hyoscine $\frac{1}{16}$ gr. at 11 p.m., the eighth dose, without applying the memory test. The restlessness increased, and in a short time the patient was so noisy and unmanageable that I was summoned. I found her delirious;

three nurses were struggling to keep her in bed. With more rational treatment she became quieter, but was uneasy and restless for a couple of hours; she refused to drink any water; her pulse and general condition were satisfactory. Chloroform was given at intervals, but large quantities were necessary to produce any effect. At 1.30 a.m. she asked for a drink, and took three-quarters of a pint of water; this greatly improved her condition. At 2.30 a.m., in a lucid interval, she was persuaded to drink three-quarters of a pint of weak tea. This caused further improvement, and there was little trouble afterwards, though the pains continued to be very strong. During some of the time it was impossible to keep the patient in bed when pains occurred, yet she was so much under the influence of the drug that the instant a pain was over she would go to sleep standing up with one hand on the bed-post and snore loudly. By 4 a.m. she was quiet. The baby was born naturally at 7.30 a.m., the head being tremendously moulded. Morphine $\frac{1}{2}$ gr. was given, and the patient slept till 11 a.m.

When she awoke she had no idea the baby was born, did not know what day it was, said she had felt no pain, and remembered nothing of her labour. She was exhausted for several hours, being the only patient in the whole series who was so. On the second day she was quite well, and made an uninterrupted recovery.

The baby was not asphyxiated, chiefly because all the difficulty had been at the brim, and there had been little if any compression in the cavity of the pelvis. Such compression is a far more potent factor for asphyxia than repeated doses of the drug, provided proper precautions are taken.

In this case two mistakes were made, one being too early repetition of a dose of hyoscine, and the other not giving the patient water to drink.

It is unusual for the mother's pulse to be affected by the drug; the following case, however, caused some anxiety.

CASE IV.

Multipara. Abnormally susceptible to drugs. Five minutes after the first injection at 7.45 p.m. (morphine $\frac{1}{2}$ gr. and hyoscine $\frac{1}{100}$ gr.) she became excited, and said she felt as if she was having gas, and was choking. Three minutes later she was quiet, but said the room was swinging round and she was sinking. Her pulse was feeble and only 40. She kept asking if her heart would stop, because she felt as if it would. There was no alternative but to turn up the light and examine her. As her colour and general condition were good, and she had behaved in much the same way during her first labour, when given chloroform, for which she had begged, I turned the light down and let matters proceed. She soon became quiet, but never appeared to be much under the influence of the drug; hyoscine $\frac{1}{100}$ gr. was given at 10.30 p.m., at 11.40 p.m., and at 1 a.m.; the third dose seemed ineffective, though the fourth produced more result. The patient was apparently conscious when the child was born at 1.45 a.m., but was kept quiet and almost in the dark; she went to sleep while being washed, and slept for six hours.

I was afraid this was not a satisfactory case, but the patient's account put a different complexion on it. She said she had read about twilight sleep and thought the description too good to be true, but in her opinion it was even better.

The following case shows the chief cause of failure, starting too late, and also shows that the drugs do not necessarily diminish the uterine contractions.

CASE V.

Multipara. Pains began at 3.15 p.m. when the waters broke, but the patient did not come to the nursing home till 6 p.m. Pains were then frequent and severe; at 6.20 p.m. the os was only one-third dilated and hard; morphine $\frac{1}{2}$ gr. and hyoscine $\frac{1}{100}$ gr. were injected at 6.30 p.m.; the pains were fast and furious; half an hour later hyoscine $\frac{1}{100}$ gr. was given and the pains became even more frequent and stronger. The child was born at 7.20 p.m.; the placenta quickly followed, and there was some continuous haemorrhage; this clearly came from a lacerated cervix, as the uterus was almost in a state of tonic contraction, so I plugged the uterus with iodoform gauze. The patient made an uninterrupted recovery, and went home on the twelfth day.

This patient's consciousness was but little affected, so this was classified as an unsuccessful case. The child was not asphyxiated.

The following case also shows that labour is not necessarily slowed.

CASE VI.

Multipara. Pains began at 2.30 a.m. At 4 a.m. the os was two-thirds dilated, but the head high up; morphine $\frac{1}{2}$ gr. and hyoscine $\frac{1}{100}$ gr. were injected. The patient went to sleep immediately, but awoke at 4.35 a.m. when the pains were strong and frequent. Chloroform was given and the baby, not asphyxiated, was born at 4.50 a.m. There was no haemorrhage; the patient slept for five hours afterwards and said her labour had been painless.

In both these cases only a minimum dose of morphine ($\frac{1}{2}$ gr.) was given; possibly this was a reason why the hyoscine intensified the uterine contractions.

I have already quoted one case (Case III) illustrating the value of the drugs in the minor degrees of pelvic contraction. Another is worth recording:

CASE VII.

Primipara. Pelvis contracted, the external measurements being: Interspinal, 9 in.; intercrural, 10 in.; external conjugate, 7 $\frac{1}{2}$ in. On previous examination I thought labour at term possible; when she came into the nursing home three days before term the position was transverse, and it looked as if Caesarean section would be necessary. In consultation arrangements were made for a further examination the next morning and for proceeding to Caesarean section if necessary.

Labour began at 6 p.m. the same evening; at 9.50 p.m. morphine $\frac{1}{2}$ gr. was given and hyoscine $\frac{1}{100}$ gr., and another dose of hyoscine $\frac{1}{100}$ gr. at 2 a.m. The patient slept till 10 a.m. At 10.30 a.m. chloroform was given and the opinion formed that labour could be finished naturally. After the examination the patient was allowed to become conscious; she sat up and had dinner. At 2.30 p.m. the pains became severe, so morphine $\frac{1}{2}$ gr. and hyoscine $\frac{1}{100}$ gr. were given; subsequent doses of hyoscine $\frac{1}{100}$ gr. were given at 6.30 p.m., at 11 p.m., at 1 a.m., at 3.45 a.m., and at 5.45 a.m. Altogether eight injections were given, morphine being in two of them. The pains were strong and frequent, but the patient was never conscious. At 7.30 a.m. the patient was rousing; the head had passed through the brim and the os was fully dilated; a little chloroform was given at intervals; at 8.55 a.m. 1 c.cm. of pituitrin was injected. The child was born fifteen minutes later with strong pains, the vagina and perineum being lacerated. After suturing, morphine $\frac{1}{2}$ gr. was given. The patient slept for four hours; when she awoke she had no idea the child was born, nor what time it was, nor what day it was.

The patient said that she had felt no pain after the first injection, except for a short time after dinner on the second day of labour. She was surprised to hear she had had a long and difficult labour. She had a morbid temperature subsequently owing to slight endometritis, but went home quite well on the twelfth day. The baby was not asphyxiated at birth; it weighed 8 lb. The fact that the baby was not asphyxiated in either this case or Case III, in both of which eight injections were given, shows that the risk does not depend on the length of labour nor the number of doses, but on other factors, including faulty technique.

The next case illustrates how small the dose should be in some cases, and the danger of a routine method of treatment.

CASE VIII.

Primipara. Premature rupture of membranes.

At 9 a.m. I found the membranes had ruptured, but the os was only slightly dilated. Pains were not severe during the day, but at night there was a good deal of suffering and no tendency to sleep, so morphine $\frac{1}{2}$ gr. and hyoscine $\frac{1}{100}$ gr. were injected at 10 p.m. The patient soon went to sleep, and slept heavily for nine hours. The next day the pains were never severe, so no treatment was necessary, the patient sleeping a little at night. On the morning of the third day pains were severe, so morphine $\frac{1}{2}$ gr. and hyoscine $\frac{1}{100}$ gr. were given at 9 a.m. Subsequent doses of hyoscine $\frac{1}{100}$ gr. were given at 12.30 p.m., 3.20 p.m., 6 p.m., 8.20 p.m., and at 10.30 p.m.; altogether six doses were given in the third day of labour. The child was delivered with forceps at midnight; it was not asphyxiated. The patient remained asleep an hour longer; when she woke up she thought it was 9 a.m., and said she had felt no pain that day.

Amnesia: The Memory Test.

The object of treatment is to produce, not analgesia, but amnesia (loss of memory for recent events). It should begin as soon after labour has started as there is real suffering. It is not advisable to administer a dose within two hours of delivery, so a little chloroform, or chloroform and ether, may be required in the final stages. Absolute quiet in a darkened room is essential, no one but the necessary attendants being admitted; the patient must not be encouraged to talk, but reasonable questions should be answered. The patient must be treated as if under a general anaesthetic, the catheter being used if necessary. The medical attendant ought not to leave; under no circumstances should he go, unless he can be quickly recalled by telephone. Close supervision is required. The fetal heart must be examined before each dose, but frequent examinations are not desirable. On two occasions immediate delivery was indicated by slowing of the fetal heart, but in both the child was saved.

Till considerable experience has been obtained, no dose after the second must be given without the use of Gauss's memory test; the patient is shown some well-known object, such as a feeding-bottle or a stethoscope, and half an hour later shown the same object and asked if she has seen it before; if she cannot remember she is still so far

under that a further dose is dangerous. With experience, however, I found like several others that I can gauge whether the patient is under or not by noticing her demeanour and attitude and conversation. This is easy if a few minutes after one has conversed with the patient she turns to the nurse and asks if the doctor has come yet this morning. The patient never required a second dose who, when asked if she had had any pains since I left the room, said, "Oh, I don't know; have I, nurse?" Another patient who had been under treatment for twenty hours and had repeated injections, settled the question of an additional dose by saying, "Oh, doctor, the pains are beginning to get a little sharp; you will begin the twilight sleep soon, won't you, and not make the mistake of leaving it till it is too late."

At first some failures in relieving pain are all but inevitable; with increased experience success may be assured. Time, however, is essential; many go under in twenty minutes or less and never require another dose; others require two or three doses, or even a little whiff of chloroform after the third dose. More than three hours, therefore, may elapse before the patient is under. Partly for this reason, and partly because the worst cases of asphyxia occur if the child is born within a few hours of the administration of morphine, it is not wise to carry out the treatment unless the patient presents herself not less than four hours before delivery may be expected.

In illustration of my contention that failure to relieve suffering is due to faulty technique, I may state that of the thirty hospital cases only three were unsuccessful, and two of those occurred in the first three of the series; the first was due to too small an initial dose, which was not repeated; another was due to beginning too late. In the thirty private cases, which I did not begin till after I had had several in hospital, four were unsuccessful in that they got but little relief; three of these occurred in the first four; two of them might be called partial successes, especially as one was so satisfied that she returned for the same treatment. As illustrating the value of improved technique I may say that although her second labour was as long as the first, and she only had the same quantities of the drugs, yet she said she never felt any pain from the time of the first injection. The two complete failures were due to beginning too late, the patient having been in labour several hours and being nearer delivery than I estimated.

It is sometimes said that the use of scopolamine-morphine necessitates more frequent employment of forceps; in the thirty private cases forceps were applied ten times—not a big percentage—as it is my custom to terminate labour with as little delay as possible, and several patients came because they had contracted pelvis, and had had difficult labours previously. In the thirty hospital cases forceps were applied six times.

In the hospital cases labour was very long—twenty-four and a half hours on the average; this is not the effect of the drugs, as most were primiparae, and many had already been many hours in labour before they came under treatment. It is to be explained by the fact that in a hospital where patients are admitted only after labour has begun, few, if any, cases of easy labour are available for treatment. In the private cases, where treatment could be started at the beginning of labour, the average time was 22.6 hours for primiparae and 7.2 for multiparae; this does not differ much from the average, especially if allowance is made for the fact that rapid cases of labour are necessarily excluded.

Summary and Conclusions.

The great bugbear is an asphyxiated or stillborn baby; in the absence of an obstetric abnormality which would with any treatment have produced the condition, faulty technique is to blame. In the series of thirty private cases seven babies showed some degree of asphyxia; four of these occurred in the first seven; the three others presented only a mild degree (oligopnoea) and two of these occurred with contracted pelvis. In the first of the asphyxiated cases forceps were required; the next was a small child more than two months premature, while the mother of the third had had phthisis and a previous miscarriage, and in this pregnancy had suffered from severe tachycardia. In the series of thirty hospital cases there were six cases of asphyxia; three of them occurred in

the first eight. In addition to the thirteen cases of asphyxia in the whole sixty, four were stillborn; only one of these occurred in the private cases; as the fetus was macerated and only one dose had been given four hours before birth, the drugs were not to blame. The three others were hospital cases of contracted pelvis who ought to have been treated by induction or Caesarean section, but only came into hospital after being examined outside and after being in labour for many hours. In one, forceps having been applied unsuccessfully both before and after admission to hospital, version was performed, but the aftercoming head had to be perforated. In the second, a primipara, the child was born after more than seventy hours of labour; only one dose was given, and this was not responsible for the delay, but the facts that the child weighed 8 lb. and the diagonal conjugate measured only 3½ in. The third was a breech case in a multipara; labour lasted for thirty-four hours, there being great delay in the extraction of the aftercoming head. These facts, and the further facts that several cases had pelvic contraction, while one was a face case, one an occipito-posterior persistent lasting twenty-one hours and delivered by forceps, one a twin labour lasting sixty-three hours, both babies being born alive and not asphyxiated, one a rigid cervix treated by version forty hours after labour began, and another a rigid cervix treated by dilatation and the introduction of a Champetier de Ribes bag, labour lasting seventy-seven and a half hours, show that the fetal mortality is not increased. In two cases forceps had to be used owing to slowing of the fetal heart; both babies were saved.

Some patients had only one dose, but most a larger number; three had eight injections and one nine, the average number being 2.8 in hospital cases and 3.13 in private practice. Several patients slept continuously, others slept in the intervals, waking when pains occurred, but remembering nothing afterwards. One patient said the baby was not hers, as hers was still unborn, the house-surgeon having given her an injection which had stopped everything! In the thirty hospital cases three had morbid temperatures, but two of these had been examined before admission. In the thirty private cases only one (Case vii) had a morbid temperature. Two patients, one in hospital and one in private, had some *post-partum* haemorrhage, for which the uterus was plugged. One hospital patient was peculiar for two days after treatment; her husband said she was of a very excitable nature. All the patients did well afterwards, and all were able to go home in fourteen days. All the babies were satisfactory.

The drugs are powerful and treatment must not be lightly undertaken, but with experience, care, and close supervision the treatment does not involve any risk other than those inherent in labour itself. The relief of suffering is an enormous gain, but an even greater advantage is that, owing to the elimination of all nervous shock and exhaustion, patients are well when they wake, and present a marked contrast to those women who have gone through in the ordinary way. The close supervision and control of the patient in bed reduces the risk of infection, and enables all emergencies to be promptly dealt with. The diminished fetal mortality and morbidity of the mother shown in all statistics of cases treated on Gauss's lines follow as a matter of course.

OBSERVATIONS ON PAINLESS CHILDBIRTH.

WITH NOTES OF FIFTY CONSECUTIVE CASES TREATED
BY THE HYOSCINE (SCOPOLAMINE) AND
MORPHINE METHOD.

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So much has been written both for and against the use of the hyoscine (scopolamine) and morphine method in labour that a brief account of fifty consecutive cases in which the treatment was successfully administered may be of interest.

Dosage.—When the scopolamine-morphine method first came into prominence in this country we were told that, in order to ensure success, it was essential for the practitioner to remain in attendance throughout the labour.