cases would be reported; that the incidence would be seen to be higher; that treatment would be more widely understood.

The obstetrician had carried in his mind for years the dictum that, if inversion of the uterus should occur immediate replacement should be attempted. On perusing the literature he found that this was an almost universal belief. DeLee dissented; he favours waiting until shock has been corrected, but, if hæmorrhage is a factor, he too favours attempt at immediate replacement. Zangemeister was the only other dissenter found; he believes that no attempt at replacement should be made until shock has subsided. In this case the patient showed no sign of shock. In this case pressure on the musculature of the fundus produced shock in an apparently well patient so quickly and so deeply that this writer is convinced that immediate reposition should never be attempted, that tamponade should be resorted to until the nerve endings with which the muscular coats of the uterus are so abundantly supplied are accustomed to their new environment. The sudden inversion of the uterus is one insult to the nerve supply, if this does not produce shock then it is our opinion that immediate attempt at replacement is a second insult which will.

After failure of two well known methods, the procedure described above served nicely in this case. It has to our knowledge never been described before. What seems to stand out in the operative report, though, is that, the fundus, after 36 hours of acclimatization to its new position can be handled with impunity in so far as shocking the patient is concerned. We have described above how quickly and how deeply shock was produced when immediate attempt at replacement was made. We would therefore suggest that attempt at immediate replacement of the uterus is never advisable.

SUMMARY

From observation of one case of this rare condition we believe:

1. That atraumatic spontaneous inversion of the uterus is a true clinical entity.

2. That immediate replacement of the inverted uterus is never advisable.

3. That a manœuvre for reposition described above is well worthy of consideration.

4. That this manœuvre is easier of execution and carries less threat to the thinned uterine musculature than procedures previously published.

5. No bibliography is given. So many writers were consulted, so little of detailed description found, that, in this report, the majority opinion is given as the opinion currently held. The painstakingly detailed, completely inclusive article of DeLee in his textbook is the outstanding exception to this statement.

RÉSUMÉ

L'observation et le traitement d'un cas de la très rare complication obstétricale qu'est l'inversion utérine permet de recommander aux accoucheurs les précautions suivantes: il ne faut jamais réduire l'inversion immédiatement après sa production parce qu'une telle manœuvre est dangereuse à cause du shock inévitable; le tamponnement pendant 24 ou 36 heures habitue la muqueuse utérine aux pressions extérieures, permet d'éviter le shock et assure la réduction facile. La littérature sur le sujet est floue et contradictoire. Il semble que la procédure employée chez la malade observé soit celle qui doive faire loi. JEAN SAUCIER

THE INTRAVENOUS USE OF NOVOCAINE AS A SUBSTITUTE FOR MORPHINE IN POSTOPERATIVE CARE*

By Surg. Lieut. J. A. McLachlin, R.C.N.V.R.

THE idea of intravenous injection of local anæsthetic is not new. It was first advocated by Bier in 1909 who used it for the extremities only. He elevated the limb and applied an Esmarch bandage to express blood from the limb. A tourniquet was then applied to prevent re-entry of the blood into the limb and also the local anæsthetic from escaping into the general circulation. Local anæsthetic agent was then injected into the veins distal to the tourniquet.

In 1937 Lewy administered local anæsthetic intravenously in the treatment of tinnitus aurium. In 1940 at the Mayo Clinic it was used for pruritus associated with jaundice. Their method was either to inject 20 c.c. of a 0.1% solution of procaine hydrochloride over a period of 2 minutes which gave 2 to 4 hours of analgesia or 1 gram in a litre over several hours which gave a much longer period of analgesia. Finally in December 1943, Major R. A. Gordon, R.C.A.M.C., reported a series of 10 cases of burns which had been given surgical treatment under intravenous procaine hydrochloride. He

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found that 1 gram in 500 c.c. of normal saline run in over a period of 1 to 1½ hours was the most effective. He was able to do his preliminary treatment painlessly and have the patient comfortable for 10 to 12 hours postoperatively.

It was suggested that we might try this method as a substitute for morphine postoperatively, since it would possibly cut down the incidence of pulmonary and vascular complications, by having conscious cooperative patients who could help themselves in the matter of deep breathing and moving about in bed rather than be semi-conscious and inert under the effects of morphine. Also it would alleviate any postoperative vomiting due to the morphine itself.

Animal experimentation has shown that procaine is rapidly absorbed from the tissues into the blood stream where it is quickly hydrolyzed and detoxified by an enzyme which breaks it down into para-amino benzoic acid and diethylaminoethanol. The toxic symptoms decrease even though the blood concentration of these latter two substances rises. The products of detoxification then leave the blood stream rapidly until an equilibrium is reached between the blood and all the other tissues. These products are excreted by the kidney within 10 to 12 hours. Procaine possesses a marked affinity for nerve fibres without injuring other cells. It is also a convulsant and stimulant of the cerebral cortex.

The question of individual sensitivity was considered. Reaction to procaine is rare, but a skin test can be carried out. An intradermal wheal is made with 1 c.c. of a 1% solution. In sensitive people there is a marked local reaction, with systemic signs of dyspnœa and agitation. Lundy of the Mayo Clinic claims that the systemic reaction is the only real contraindication. The reaction occurs within 10 minutes. Ten tests carried out on the ward produced an area of redness corresponding to the size of the wheal; none showed a systemic reaction. All of these subjects had previously had local anæsthesia for minor lacerations and dental extractions without any untoward effects. The skin test is unnecessary if the patient gives a history of previous use of procaine without ill effects. In our cases we have made a further check by keeping the patient under personal observation for the first 10 minutes while the intravenous solution is running in slowly. In that procaine is rapidly detoxified in the blood stream we considered that if any reaction did develop the solution could be discontinued immediately and the blood would rapidly hydrolyze the procaine already given. None of the cases reported by Major Gordon showed any reaction whatsoever. In our series two cases showed a rise in blood pressure of 15 points while the rest were unchanged.

Reactions are either of the central nervous system convulsant type indicated by agitation etc., which can be controlled by intravenous sodium luminal, or of respiratory circulatory embarrassment which can be treated by adrenalin hypodermically. A case of the latter type following intramuscular injection for myositis is reported in the *British Medical Journal*, February 13, 1943. This case showed almost complete recovery in 10 minutes following the injection of 2 minims of 1:1,000 adrenalin hydrochloride hypodermically.

We considered, since the novocaine tends to reach an equilibrium in all the body fluids, that our maximum point of action is in the area of the operative field since this has the greatest fluid supply due to the serum seepage and the increased vascularity of the reparative process.

Our series of cases consists of 10 major surgical patients; 5 extensive subtotal gastrectomies, 1 Finney pyloroplasty, 1 cholecystectomy, 2 hernial repairs and 1 lobectomy. The first two cases were given considerable morphine partly because of our own skepticism in the use of novocaine and partly because of not wanting to use the novocaine at night when the patients were in charge of student nurses only. However, they serve as an excellent example for comparison between morphine and novocaine therapy. The antagonistic effect of novocaine on sulfathiazole is recognized but none of our cases developed any infection in the wound. All of the cases showed no untoward effects and the last eight had almost pleasant postoperative courses.

CASE 1

Male, aged 60, extensive subtotal gastrectomy for ulcerative carcinoma. Patient given morphine grains 1/6 for pain 15 minutes after return from the operating room. One and three-quarter hours later patient again very restless and complaining of pain. Given 1 gram of novocaine crystals in 500 c.c. of normal saline over a period of one and one-quarter hours. In a few minutes he became quieter and comfortable. Remained so for 5 hours when on complaining of pain was given morphine grains 1/6. In the first 24 hours postoperatively he was given 3 more 1/6 grains of morphine making 5 in all. In the second 24 hours he received morphine grains 1/6 five times, in the third 4 times and in the fourth 3 times.

On the fifth day he was given codeine grains ½ twice. On the sixth, seventh and eighth days still complaining of some discomfort, but no sedative given. On the fourth day postoperatively the patient developed a cough which was treated with a sedative cough mixture for 6 days. Discharged on the fourteenth day without any complaints.

In surveying this case we see the novocaine gave the longest and most comfortable period during the early postoperative course.

CASE 2

Male, aged 43, extensive subtotal gastrectomy for gastric and stomal ulcers. Previous gastroenterostomy undone. Two hours after his return from the operating room and patient became very restless and complained of severe pain. He was given 1 gram of novocaine crystals in 500 c.c. normal saline intravenously over a period of 1 hour and ten minutes. Within 10 minutes of beginning he felt easier and was quite comfortable before the intravenous was completed. Three hours later he was still comfortable, but began to complain at the end of five hours. At this time he was given morphine gr. 1/6 and this was repeated twice at four hour intervals during the first night. Nurse's chart records a poor night for the patient. The first morning postoperatively he was once again given 1 gram of novocaine which gave him a comfortable period of 6 hours. In the second 24 hours he was given morphine grains 1/6 four times and chart records a poor night. His third 24 hours again shows morphine 1/6 four times. On his fourth day he was changed to codeine gr. ss P.R.N. He developed a cough on his fifth day and required a sedative cough mixture for 7 days. He was discharged on the fourteenth day.

Here again novocaine gave the longest intervals of freedom from pain. We were loath to repeat it before the 12 hours recommended, but have since considered that with the continuous intravenous being used postoperatively we were likely speeding up the excretion of the drug via the kidneys.

CASE 3

Female, aged 59. Finney pyloroplasty for stenosing peptic ulcer. Patient given morphine grains 1/6 for pain 45 minutes after return from the operating room. Seven hours later complaining of severe pain and very restless. One gram of novocaine in 500 c.c. normal saline administered intravenously over a period of one and one-quarter hours. Nine and one-half hours later (4.30 a.m.) given morphine gr. 1/6 for pain. Patient again complaining of pain in 5 hours so 1 gram of novocaine given. She now had a period of 12 hours in which she was comfortable and free from pain. A further gram of novocaine was given at this time, (36 hours postoperatively). Nothing further was given for pain and the remainder of her recovery was uneventful and comfortable. She was discharged the sixteenth day.

In this case the morphine was given once during the night because of hesitancy in giving the novocaine with only a student nurse in charge. The long periods of action of the drug in this case may be explained by the fact that the patient only weighed about 100 pounds so that we were in fact using a proportionately larger dose.

CASE 4

Male, aged 55, extensive subtotal gastrectomy for chronic gastritis with gastric ulcer. This patient returned from the operating room at 2.00 p.m. but did not regain consciousness till 6.00 p.m. At 7.00 p.m. he was given 1 gm. of novocaine intravenously in a period of 70 minutes. He was quite comfortable and had a good night. At 10.00 a.m. the next morning the novocaine was repeated. He was given nothing further for the pain for 42 hours (4.00 a.m.) when he required morphine grains 1/6. The rest of his course was uneventful and the patient remarked on his freedom from pain during his postoperative recovery.

CASE 5

Male, aged 58, extensive subtotal gastrectomy for two peptic and one erosion ulcer all along the lesser curvature. Four hours postoperatively given 1 gm. of novocaine for pain and restlessness. This was repeated in five hours. Patient had a fairly good night. Patient continued to be comfortable without further sedative till 63 hours postoperatively (3.00 a.m.) when he pulled out his Wangensteen tube during his sleep. He became uncomfortable and was given morphine grains 1/6. He had no further pain and was discharged on the fourteenth day.

CASE 6

Male, aged 62, extensive subtotal gastrectomy for stenosing peptic ulcer. Five hours postoperatively became restless and complained of pain. One gram of novocaine given intravenously. Patient became quiet and comfortable and cooperated well with moving in bed and deep breathing. Eight hours later novocaine again given for restlessness and pain. Records show the patient then became comfortable and had a good night. No further sedatives were required for pain and the remainder of his postoperative course was comfortable. On the fifth day the patient was allowed up in a chair, on the sixth day had bathroom privileges and on the thirteenth day he was discharged.

CASE 7

Female, aged 50, cholecystectomy for chronic cholecystitis with cholelithiasis. Patient did not require sedative for pain until 20 hours postoperatively. At this time she began complaining of severe pain in area of incision. After half of the 1 gm. of novocaine solution was run in the patient said her pain was entirely gone. The novocaine was stopped and no further sedative was required during her recovery. She did not have any vomiting after completely coming out of her anæsthetic. A 70-year old woman had the identical condition and operation the same day. This patient was given morphine grains 1/6 3 times the first day, twice the second and once the third. She developed persistent vomiting the second day which only cleared up by putting down a Wangensteen tube and leaving it there for 72 hours. The patient given novocaine was by far the most comfortable.

CASE 8

Male, aged 56, bilateral inguinal herniotomy with fascial repair. Patient given 1 gram novocaine 2½ hours after return from the operating room. He slept fairly well the first night and was quite comfortable the following morning. The afternoon of the second day he was given one aspirin tablet. He required no further sedative during his postoperative course.

CASE 9

Male, aged 25, lobectomy for bronchiectasis. Patient returned from operating room almost conscious and soon was very restless and complaining of severe pain. Given 1 gm. novocaine and within ½ hour was quieter and comfortable. This was repeated 3 times in the first 24 hours at the gradually increasing intervals of 3, 5 and 9 hours. In the second 24 hours 1 gm. novocaine was given twice with a 9 hour interval. He required no further sedative during his postoperative course. His special nurses, all of whom had had previous experience with this type of case, stated that his postoperative course had been exceptionally easy.

CASE 10

Female, aged 38, repair of large lower abdominal ventral hernia. This patient was given 1 gm. novocaine the afternoon of her first day postoperatively. She required no further sedation and had an amazingly comfortable time. We consider this case to be an excellent one as the patient was one of the "old faithful" at the hospital and on her many previous appearances had been a constant complainer. She volunteered that she had not minded this operation in the least.

SUMMARY

1. Ten postoperative cases are described in which novocaine intravenously has been substituted for morphine. The results are extremely encouraging.

2. Novocaine can be given intravenously with safety.

3. Individual sensitivity is guarded against.

4. Novocaine intravenously has the advantage over morphine in that it allows conscious patients who can assist themselves in precautions against postoperative pulmonary and vascular complications.

5. The factor of the vomiting and malaise due to morphine therapy is eliminated.

6. The long-standing concern over accidental introduction of local anæsthetic into veins during tissue infiltration is apparently unfounded.

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ANCILLARY SERVICES IN INDUSTRIAL HYGIENE*

By N. L. Burnette

Assistant Vice-president, Metropolitan Life Insurance Company, Ottawa

COINCIDENT with the growth of medical services in industry there have developed other activities designed to conserve the health and vigour of work people. These ancillary services can be classified under two headings: Plant Safety, and Employee Welfare Plans. Probably the first received considerable impetus from the introduction of compensation legislation and the impact of these laws on the pocket book of the employer. While the initial interest may have been somewhat narrow, the safety movement today takes a liberal view of its responsibilities. Within its own ranks it has developed specialists with a high degree of professional competence.

Welfare work for employees is a term used in a loose and not altogether satisfactory manner to describe some of the by-products of the laudable desire on the part of both labour and management for better working conditions and harmonious personnel relationships.

From the beginning the industrial physician must have had some awareness of what was being done in connection with plant safety, if only because he was called upon to treat the end results of unsafe practices. That in the past the interest of the plant physician has been somewhat detached from other industrial welfare activities is nobody's fault. Only within recent times have business administrators had an accumulation of experience of welfare plans sufficient to warrant evaluation. Out of this stock-taking has grown realization of the fact that the prevention and treatment of disabilities among employees and programs in industry for the development of the fuller enjoyment of life, have the same aim: the provision of the best possible conditions of employment. In the words of the president of one large commercial concern,[1]

> "He rejected the narrower vision of industrial health. . . . He believed it should be based rather on a very wide philosophy, resting on the dictionary definition of health as physical, mental and moral soundness. Acceptance of this definition as applicable to industrial health must inevitably lead into a program embracing the production and development of the workers' good health at home, as well as in shop or office. It would also embrace nutrition; job security and freedom from personal worry to ensure serene mental health; and sound sympathetic industrial relations in the interest of moral health."

Coming from such a source and expressed with such clarity these views may well indicate the trend of the future. The extent to which businesses or perhaps groups of businesses will implement a fully rounded program will vary with conditions. But if the spirit and principle become a guiding force it is reasonable to expect that management in industry will favour a degree of integration of what today are somewhat scattered efforts on behalf of the well-being of employees. This does not necessarily imply centralization. Probably what will be asked for is a pooling of the skills possessed by leaders separately entrusted with various phases of a

* For previous articles see *Canad. M. Ass. J.*, **51**: 439, 521, 1944, and **52**: 55, 136, 271, 1945.