at each of them and no correlation between the storage temperature and the number of cases could be made out.

The butcher who was the source of the staphylococcus causing the outbreak had local treatment for the lesion in his hand, which soon healed. He also had a course of sulphathiazole, and swabs from his nose, throat, and hand are now negative.

This experience has shown the value and importance in such outbreaks of close liaison between all interested parties and the necessity for thorough and prompt investigation by a bacteriologist with up-to-date services at his disposal.

Summary

An outbreak of toxic food-poisoning following the consumption of pressed pickled beef sandwiches is described. The evidence showed *Staph. pyogenes aureus* (phage type 47/47C) to be the cause. Personnel handling food should pay scrupulous attention to personal hygiene and especially to lesions, however slight.

Close liaison between all interested parties was an important factor in finding the cause.

Our thanks are due to Drs. Hall, Brothwood, and Carroll and the staff of the Lancashire County Council Public Health Department, especially Mr. Eckersley and Mr. Ward, for providing many of the circumstantial details. We also wish to thank Prof. H. B. Maitland for his criticism and advice.

Drs. Allison and Williams, of the P.H.L.S. Central Laboratory at Colindale, kindly phage-typed the staphylococci for us, and Mr. C. H. Walker, analyst to the Lancashire County Council, performed the chemical analyses.

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d-TUBOCURARINE IN CAESAREAN SECTION

BY

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Anaesthesia for caesarean section is a subject full of controversy, but the advent of *d*-tubocurarine seems to offer a solution to some of its problems. It assures an easy induction and eliminates any necessity for harmful doses of toxic anaesthetic agents. This report on a series of 30 such operations in which this drug has been used is published in the hope that it will encourage others, who may have greater opportunities in this field of anaesthesia, to explore its possibilities. It is hoped that the constancy in results may convince despite the paucity in numbers.

Technique

The best results were obtained with the following technique and dosages. As premedication, 1/100 gr. (0.65 mg.) of atropine is given one hour before operation. When the surgeon is scrubbed up and ready, the induction is carried out on the table with an injection of 15 mg. of *d*-tubocurarine ("tubarine";—Burroughs Wellcome and Co.) followed by 0.3 g. of "kemithal" (cyclohexenyl-allylthiobarbiturate) in 5% solution. Anaesthesia is maintained with cyclopropane, using the closed circuit. The loss of consciousness which results from the initial injection is, however, only transient, and it is necessary that the face-piece of the anaesthetic apparatus be applied without delay. Respiration is "aided" (Gray and Halton, 1946) from the beginning, for it is of paramount importance that the small

amount of depression that may result from this dose of *d*-tubocurarine must not be allowed to result in any suboxygenation.

The operation is started as soon as the patient fails to respond to painful stimuli. An early indication as to when this plane has been reached may be afforded by the reaction of the patient to the application of the towel clips. Up to the time of delivery of the child the anaesthesia must be kept as light as possible. It has been found useful to turn the absorption canister out of the circuit for a few minutes before the uterus is incised. In such a short time this has probably little effect upon the mother, but may build up a carbon dioxide tension in the foetal blood which may well contribute to the early commencement of respiration by the baby. After delivery the anaesthesia is deepened as required, but it is not necessary to carry it lower than deep first plane. A pharyngeal airway is not usually inserted. In fact it is inadvisable, as this procedure may well precipitate vomiting. Endotracheal tubes and a laryngoscope are always to hand, but have been found necessary only on the one occasion described later.

Results

There has been a certain dependability about the results of this technique which has been encouraging. There is no anxiety with regard to depression of the infant. With the exception of two understandable cases these babies have all cried most lustily as soon as the head was delivered. They have been quite unusually lively and have shown no evidence of curarization. One of the exceptions was an infant who was rather sleepy but cried after five minutes. In this case thiopentone, 0.15 g., was used for induction instead of the usual "kemithal." The other was a premature baby of 32 weeks weighing 3 lb. 2 oz. (1.42 kg.), and the mother was eclamptic, having had several fits before delivery. This baby took six minutes to expand its lungs.

An increased contractility of the uterine muscle has been observed. The placenta always separates very easily and the uterus contracts down firmly. The injection of "pituirine" (pituitary lobe extract) which had always been routine was continued in the early cases before this feature was appreciated. It was seen to be unnecessary and has been abandoned. Five patients who it was felt might be predisposed to post-partum haemorrhage received 0.5 ml. of pituitrin. The usual indication for this was a justifiable apprehension on the part of the surgeon rather than any unsatisfactory condition of the uterus. Nineteen patients who had no uterine stimulant showed excellent contraction throughout, and not infrequently clots have been observed extruding through the cervix at the end of operation.

As a result of the extremely light anaesthesia the patient wakes up as the dressings are applied, and she often has been told the all-important news before she leaves the theatre. On occasion there have been slight residual signs of curarization at the end of an unusually quick operation, but only twice has it been necessary to inject adequate doses of "prostigmin" and atropine. This has always resulted in complete recovery.

Post-operative vomiting or retching is rare, and is only minimal when it does occur. One of the patients under review developed a chest complication, but it was of doubtful nature and had completely cleared up within 48 hours. There was no evidence of any undue retention of urine; nor have any eye symptoms as reported by Langton Hewer (1946) been seen. There has been no case of ileus.

Discussion

The ideal anaesthesia for this operation should be safe and, if possible, pleasant. It must provide good working

conditions for the surgeon and be non-depressing to the baby and the uterine tone. The safest technique to date has probably been local analgesia, but there are few who would care to maintain that this is a pleasant experience. Some of these patients who had undergone previous sections have been most grateful for the intravenous induction and the subsequent freedom from unpleasant sequelae.

d-Tubocurarine has passed its experimental stage, and its early promise has been confirmed by further extensive experience. It is debatable whether any potent drug which is delivered into the blood stream can be called safe, but this one seems to be less dangerous than many others in daily use. On the other hand, among these patients were five who were seriously ill: two had eclampsia, having had several fits, two had had extensive haemorrhage from placenta praevia, and one had advanced pulmonary tuberculosis. They all had an uneventful convalescence and with the exception of the last mentioned were fit for discharge within three weeks.

Vomiting during the induction of anaesthesia with consequent aspiration pneumonia is acknowledged to be one of the hazards of this procedure. These patients have not had the usual sedative preparation. They are often admitted as emergencies "off the district," and are not infrequently stout and short-necked. All these factors tend to make the induction period a rather anxious time. The ill-advised insertion of an airway immediately after the initial injection did precipitate vomiting in one instance. A cuffed endotracheal tube was inserted, and the fact that suction was ready and to hand prevented any untoward result. Whatever the anaesthetic, these patients are very likely to vomit if they have had a recent meal. A rapid intravenous induction makes the emergency less likely, and the administration of *d*-tubocurarine undoubtedly facilitates the intubation which may be required as either a prophylactic or a therapeutic measure.

The freedom from curarization of the baby has not been surprising. Whitacre and Fisher (1945) have reported that "intocostin" (Squibbs's biologically standardized extract of curare) has no effect on the infant—an observation which has been confirmed in the present series. Substitution of "kemithal" for thiopentone as an inducing agent and the small amount of anaesthetic which is required after *d*-tubocurarine are factors which have contributed to the wide-awake condition of these babies.

The good uterine tone that has been so marked a feature was not expected. This has been so striking that on two occasions it caused a temporary embarrassment to the surgeon, who found that his hand was being gripped by the contracting uterus as he extracted the child. This has so far not proved a serious handicap, and the otherwise good operating conditions have been ample compensation.

Finally, this technique, by avoiding long post-operative depression, which is especially menacing after this operation, undoubtedly contributes to a peaceful and trouble-free convalescence.

Summary

A technique for anaesthetizing patients undergoing caesarean operations using *d*-tubocurarine, "kemithal" and cyclopropane is reported. It has been used in 30 cases and the results are reviewed.

My grateful thanks are due to Mr. Percy Malpas and the other members of the obstetrical team at Whiston County Hospital for their help and confident co-operation.

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USE OF *d*-TUBOCURARINE CHLORIDE AND THIOPENTONE IN ELECTRO- CONVULSION THERAPY

BY

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Convulsion therapy for the treatment of psychiatric disorders was introduced in 1934 by Meduna, who injected convulsant drugs intravenously. The treatment, however, was so unpleasant that patients were unwilling to continue with it; the considerable rise in blood pressure that occurred rendered it unsuitable for cardiac and arteriosclerotic patients, and fractures and dislocations were very common. The introduction of electrical convulsion therapy (E.C.T.) (Cerletti and Bini, 1938) diminished the frequency of traumatic complications; but this form of therapy was still unpleasant for the patient, and the rise in blood pressure resulted in cardiovascular accidents which were sometimes fatal. Twenty deaths attributed to E.C.T. have been reported, and 16 of these were either definitely or probably due to cardiac failure (Feldman *et al.*, 1946). By the use of E.C.T. with hyperextension of the spine and mechanical restraint the incidence of compression fractures of the spine has been reduced to about 4% (Cook, 1944), although occasional fractures cannot be prevented. The use of spinal anaesthesia, which has recently been introduced to soften convulsions (Shorvon and Shorvon, 1943), is very limited, as it does not prevent fractures of the arms or jaw, it cannot be used in patients with high or low blood pressure, and it carries with it all the hazards of spinal puncture. Although Bennett (1940) was the first to report on the use of curare for softening convulsions in shock therapy, *d*-tubocurarine chloride, an alkaloid obtained from crude curare, was used at Woodside Hospital for a considerable time before the publication of this paper. Unfortunately the work was interrupted by the war and was not followed up (Palmer, 1939, 1946). Since 1940 many American workers have confirmed Bennett's observations without, however, modifying his technique.

Curare-like drugs minimize convulsions by paralysing voluntary muscle. They do this by blocking the nerve impulse at the myoneural junction, probably by preventing the effector substance in the muscle from reacting to acetylcholine. In the doses in which it is used clinically *d*-tubocurarine chloride acts almost exclusively on voluntary muscle and produces few side effects if oxygenation is adequate. A slight fall in blood pressure may occur immediately after its intravenous injection, followed by a slight rise. It has no significant effect on the human electrocardiogram (Gray and Halton, 1946; Prescott *et al.*, 1946). A slight overdose can, however, seriously depress respiration by paralysing the diaphragm, and both bronchospasm and laryngeal spasm have occurred following its use without an anaesthetic (B. G. B. Lucas, personal communication).

Preliminary Investigations

American workers report that combined curare and convulsion therapy is dreaded less by the patient than