maintain a temperature of 40° C. (104° F.) in patients for long periods, but since it is customary to administer streptomycin by a single dose daily it might be practicable to enhance the effect of the streptomycin by inducing fever during the period of maximal concentration in the tissues. Unfortunately, the effects on tubercle bacilli of short exposures to hyperthermia and streptomycin cannot be conveniently studied *in vitro* owing to the difficulty of reproducing the changing streptomycin concentrations that occur in a treated patient.

Smith and Vollum (1950) observed that certain cases of tuberculous meningitis benefited by the administration of tuberculin intrathecally during treatment with streptomycin. Their records show that a febrile reaction was provoked by the tuberculin injections, and it is possible that the beneficial effect of these injections was due, in whole or part, to the combination of the fever they produced and streptomycin. As injections of tuberculin are hazardous, it is important to ascertain whether they can be replaced by fever therapy, which may be applied in a controllable form.

It is hoped that animal experiments will provide further evidence of the synergism of hyperthermia and streptomycin and *p*-aminosalicylic acid. Such experiments should not, however, preclude clinical trial, because the reaction of man to infection by the tubercle bacillus cannot be exactly reproduced in any animal. As a direct action on the organism is aimed at, the induction of a temperature of at least 104° F. (40° C.) should be attempted; it should be reached approximately one hour after the injection of streptomycin and be maintained for four to six hours. The number of such courses would vary with the tolerance of the patient, but it is probable that they would best be given on successive days. *Para*-aminosalicylic acid could be administered at the same time.

Summary

About 25% of strains of *Myco. tuberculosis* (human type) grew very poorly in Dubos's medium at 40° C. The growth of the remainder was slightly or moderately impaired.

The sensitivity of strains growing sufficiently well for testing at 40° C. was considerably increased to streptomycin, *p*-aminosalicylic acid, and often to thiosemicarbazone, but not to mercuric chloride.

Reasons are advanced for trying a combination of hyperthermia with streptomycin and *p*-aminosalicylic acid treatment in tuberculosis of man caused by the human type of bacillus.

I am indebted to Dr. B. A. D. Stocker for a discussion of the mechanism of the phenomena recorded, and to Dr. G. S. Wilson and Dr. Scott Thomson for improvements in the presentation.

REFERENCES

- Duncan, G. R., and Mariette, E. S. (1937). *Amer. Rev. Tuberc.* **36**, 387.
Kling, D. H., and Rubin, H. M. (1936). *Ibid.*, **34**, 498.
Smith, Honor V., and Vollum, R. L. (1950). *Lancet*, **2**, 275.

The whole undergraduate population of the Queen's University, Belfast, was examined radiologically once in the academic year 1950-1, states the third annual report of the student health medical officer. Seventeen cases of active tuberculosis were noted among the 2,368 students, and eight of these cases had been in normal health a year previously. No reason for their breakdown in health could be found in their mode or conditions of life, and the source of their infection remained unknown.

AN UNUSUAL METHOD OF TREATING HYDROCEPHALY

BY

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Nowadays the treatment of hydrocephalus is more or less standardized: the head is collapsed per vaginam either by puncturing it with a sharp instrument, with or without drainage through a cannula, or by the passage of a hollow instrument up the spinal canal into the brain.

The following case is presented because the above methods failed when attempted per vaginam. The method employed was puncture of the head and drainage through a cannula, but it was carried out through the maternal abdominal wall. This method is not claimed as original. It is mentioned on several occasions in the literature, but no details are given. It is this absence of detail that has prompted me to publish the following case.

Clinical History

A primigravida, aged 31 and married eight years, first attended the antenatal clinic on September 20, 1949. She was then 22 weeks pregnant. The uterus corresponded in size with the duration of amenorrhoea. No abnormality was detected. Her blood pressure was 110/60; her urine was clear.

On November 17, when she was 30 weeks pregnant, the uterus was the size of a 34-weeks pregnancy. The presenting part was thought to be a breech, but the head could not be identified in the fundus. A radiograph showed a single foetus, of about seven months' maturity, presenting as a breech. The head was extended and appeared slightly enlarged. On November 19 external cephalic version was attempted, but was unsuccessful. It was then decided that an abnormal foetus with hydrocephaly was likely, and that a further x-ray examination should be made in three weeks, by which time there should be no doubt about the diagnosis.

At 9 a.m. on December 8, when 33 weeks pregnant, the patient was admitted to hospital in early labour. The membranes had just ruptured and there had been a sudden gush of liquor amnii. The findings on abdominal palpation were difficult to interpret, but a large soft swelling could be felt in the fundus, and this was thought to be a hydrocephalic head. The foetal heart rate was 120 per minute. On rectal examination the presenting part was thought to be a breech, in mid-cavity, with the os dilated to one to two fingerbreadths. A radiograph was requested, but the x-ray plant was under repair and could not be used. Uterine contractions were quite strong and were occurring every seven minutes.

At 1 p.m., on vaginal examination, a complete breech was felt, which had descended as far as the ischial spines, and the os was dilated to four fingerbreadths. By 4 p.m. the contractions were much weaker and no advance had been made. In an effort to stimulate contractions a course of stilboestrol was given—10 mg. quarter-hourly for 12 doses. The pains became stronger again about 10 p.m., but after two hours of these stronger pains there was still no progress.

At 12 midnight an examination under general anaesthesia—gas, oxygen, and ether—was carried out. The large soft swelling in the fundus was now definitely identified as a hydrocephalic head. No further dilatation of the cervix had taken place. Since the progress of labour had been arrested, the anterior leg was brought down so that the half-breech could act as a cervical dilator. At 1 a.m. she

was fully dilated and began bearing down strongly. By 2 a.m. both legs were delivered as far as the knees. At this stage further progress ceased in spite of strong bearing-down efforts.

At 2.15 a.m. a general anaesthetic—gas, oxygen, and ether—was again administered to enable a breech extraction and puncture of the aftercoming head to be carried out. In spite of strong traction on the legs it was impossible to deliver the baby further than the thighs. It was realized that the hydrocephalic mass plus probably some other abnormality was causing obstruction at the pelvic brim. Foetal ascites and extended arms were excluded as possible other causes of obstruction by palpating the foetal abdomen and feeling the arms lying along the trunk. Intra-uterine exploration failed to reveal the tumour of the neck. (The tumour must have been mistaken for the face.)

The following more usual methods of collapsing the hydrocephalus were now considered or attempted in turn, but these failed or were impracticable:

1. The absence of a spina bifida ruled out the passage of a gum-elastic catheter along the spinal canal.
2. Spondylectomy, another method of entering the spinal canal, was not attempted, because the foetal spine was not visible.
3. The longest trocar and cannula, 6 in. (15 cm.) in length, was now passed along the foetal back as far as the postero-lateral sinus of the skull, but its progress then became arrested by the large flange on its end overlapping the under surface of the maternal pubic bone. The Drew-Smythe catheter was substituted, but the soft metal bent when pressure was exerted. A fine lumbar puncture trocar and cannula was successfully introduced into the uterus past the maternal pubic bone and the skull was punctured. Only a little cerebrospinal fluid escaped and then the cannula blocked. A syringe was attached to the cannula high up in the uterus in an effort to unblock it, but access was so difficult that the syringe could not be operated.
4. Internal cephalic version might have been successful earlier, but the uterus was now too firmly retracted round the foetus.

It was therefore decided that an attempt to puncture the head through the maternal abdominal wall should be made. The bladder was again emptied by catheter and several ounces of urine were withdrawn.

A point $1\frac{1}{2}$ in. (3.75 cm.) below and to the left of the umbilicus was selected as the site of puncture. The left side was chosen because the occiput was on the left, the face on the right. A lumbar puncture needle was now easily pushed through the maternal abdominal wall, uterus, and hydrocephalic skull. Blood-stained C.S.F. escaped through the cannula. It became blocked on several occasions with brain matter, but the blockage was dislodged by forcing saline from a syringe through the cannula. The rate of drainage of C.S.F. was accelerated by bimanual compression of the foetal skull. Throughout the manoeuvre the mother remained in the lithotomy position and the foetal legs were left hanging over the edge of the bed. When the head had collapsed sufficiently to cease to be an obstructing factor, the foetus more or less fell out of the maternal pelvis, and the cannula had to be very rapidly withdrawn.

The third stage of labour was completed normally. The puerperium was uneventful.

The foetus was stillborn, female, and weighed $5\frac{1}{2}$ lb. (2.5 kg.). The head was still obviously hydrocephalic (see illustration). A large tumour was present on the front of the neck. The cervical spine seemed to be missing and the head was hyperextended.

Post-mortem examination confirmed the above findings. In addition, it was found that the cervical vertebrae were fused as in the Klippel-Feil syndrome. No other congenital abnormalities were found. Section of the cervical tumour showed only a mass of myxomatous tissue.

Discussion

The above method of treatment is obviously not the one of choice in the less-complicated cases of hydrocephaly, for there is considerable risk of injuring the maternal bladder and bowel. The risk of injuring the bladder is lessened by emptying it with a catheter first and by puncturing the abdominal wall at the level of the umbilicus. The bowel is less likely to be injured at the above site of puncture except in cases which have had a laparotomy and may have adhesions to the anterior abdominal wall.

A longer trocar and cannula would, of course, have made puncture of the head from below possible.

As mentioned above, another abnormality was suspected, because it is usually possible to deliver a hydrocephalus with breech presenting, at least as far as the umbilicus. The other obstructing features here were the tumour of the neck and the Klippel-Feil deformity of the cervical spine.

Instead of using this method only when others fail, a wider application could be claimed for it. Most obstetricians agree that it is desirable to induce labour once hydrocephaly has been diagnosed. Induction of labour when the hydrocephalic foetus is presenting as a breech is difficult because artificial rupture of the membranes is unreliable. In addition external cephalic version is often unsuccessful in these cases because of the difficulty of moving the large head. It is never wise to be too persistent in attempting version in these cases, because of the very real danger of rupturing the uterus. In such cases puncture of the head as above should facilitate version.

When the hydrocephalic head presents, induction of labour by puncture of the head from below is simple, even when the cervix has to be dilated first. Rupture of the membranes *per se* is again an unreliable method of induction, for the head does not closely fit the cervix. It would be hard in such cases to justify any more risky procedure, for the puncture through the maternal abdominal wall would have to be nearer the bladder when the hydrocephalic head is the presenting part.

Summary

A case of hydrocephalus complicated by a tumour of the neck and deformity of the cervical spine is described. Delivery was made possible by puncture of the head through the maternal abdominal wall.

This method of treatment and the more usual methods are contrasted.

No references are quoted, because this method is only mentioned *en passant* in the literature studied.

I wish to thank Mr. Harold Burton, obstetrician and gynaecologist at this hospital, for permission to publish this case and for helpful criticism in preparing this article. I am also indebted to Dr. Leo Sefton for performing the post-mortem examination and taking the photograph from which the sketch was made.