The points of special interest about these two cases are as follows. 1. The absence of any possibility of poisoning by antiseptics. 2. In both cases the operation wounds were surgically clean. In Case 1 the incisions were examined at the necropsy and found to be healthy-looking; in Case 2 the incisions healed by first intention and there was never any rise in temperature above the normal. 3. Stress has been laid on the fact that in these cases the children have often been nourished on fats, such as cod-liver oil. In Case 1 it was definitely determined that no such treatment had ever been administered; in Case 2 the patient had taken cod-liver oil at times but never continuously. 4. Both children were markedly rickety.

Manchester.

A FATAL CASE OF DELAYED CHLOROFORM POISONING.

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By the kindness and courtesy of Mr. F. F. Burghard I have been permitted to publish this case which is not without interest.

The patient was a female child, aged 6½ years, who for three years had had tuberculous disease of the right hip. At the end of the year 1905 a large abscess formed in connexion with the right hip and this was opened on the front of the thigh under chloroform. After this operation the patient suffered from a severe attack of sickness and vomiting, which commenced about six hours after the administration of the anæsthetic and lasted for two days. A sinus remained in the thigh and in January, 1907, she was again anæsthetised with chloroform and the sinus was opened up and drained. After this operation the patient made an uneventful recovery from the anæsthetic.

In November, 1907, the patient was admitted into Paddington Green Children's Hospital with signs of disease in the neck of the right femur and upper end of the bone. There was a sinus on the front of the thigh but this only discharged occasionally. It was decided to operate one week later. The general health of the child previously to her admission is of interest in view of subsequent events. Her mother gave a very clear account of periodic attacks of sickness and bilious vomiting. At the beginning of her illness three years ago she was put into a Phelps's box, in which she remained for 18 months. During that time she had frequent attacks of sickness with green vomit, and as food was being pushed to the limit of digestion it was thought that the recurrence of the attacks might be associated with this. On being taken from her Phelps's box it was observed that the vomiting attacks stopped almost entirely. Within the last year she had only one bad attack, in September, and this was thought to have been precipitated by the excitement of going to the country. Apart from these and the hip condition the child had had no other illness and none of the specific fevers of childhood. On admission the patient was observed to be of a very neurotic and excitable temperament. She was well nourished and of healthy appearance. There was no cardiac or pulmonary disease and the urine contained no abnormal constituent. There was no acetone and no diacetic acid.

A week after admission Mr. Burghard operated. He removed the great trochanter and other tuberculous bone at the upper end of the right femur and then completely excised the old sinus. The whole operation took one and a half hours, and the amount of chloroform given was 1½ ounces administered on an open mask. After the operation the patient slept for two hours before regaining consciousness. In spite of having lost little blood she was very pale. The cheeks and lips were blanched and she seemed in a very exhausted condition. The pulse-rate was 112 per minute and moderately strong in force. She retched once or twice after regaining consciousness but did not vomit till soon after midnight, when she vomited twice. During the night she slept irregularly, and when awake suffered much from malaise and nausea, though she did not vomit again. During the next two days she appeared to be very languid and took very little interest in her surroundings, and answered questions as if with effort. This languor and apathy were in marked contrast to the bright intelligence which she

possessed before operation. She occasionally cried out aloud but was otherwise quiet. Vomiting at this stage was seldom, but nausea and retching continued in spite of treatment. She had no sphincter control. She suffered from excessive thirst and this thirst was a marked feature of her illness from beginning to end. During the third day her apathy continued and now a faint odour of acetone could be detected in the breath. The pallor persisted as severe as ever, but on the morning of the fourth day the patient was noticed to be deeply jaundiced all over and the urine gave a faint reaction to the tests for bile but contained no acetone. Apart from this there was no alteration to be noted until the evening when about 9 P.M. she became wildly excited. Her eyes were staring and her expression generally was as if she had been struck with terror. The pupils were widely dilated but equal and reacted to light. She threw her arms about, shrieked aloud, and spoke incoherently. She became so violently restless that we had to confine her with a sheet to prevent her from leaving the bed. She retained reason enough, however, to indicate the presence of pain in the epigastrium. This was relieved by hot applications, but soon after the pain subsided she vomited twice and on both occasions the vomit was scanty and of typical coffee-ground material. This was the first and only occasion on which she had hæmatemesis. The odour of acetone in the breath became much more evident at this stage, but even then the urine was entirely devoid of it. During the night the restlessness continued, but on the next day she became much quieter though she was evidently more comatose. In the evening distressing air-hunger set in with markedly irregular panting breathing. This passed off in a few hours. On the next day this type of breathing returned. All nourishment that she had hitherto taken was refused. The only thing that she would consent to swallow was brandy and water and this she recognised at once and swallowed greedily. To overcome this difficulty milk and meat enules were given every four hours and these she retained. The urine on the sixth day contained a small trace of acetone for the first time and in addition a trace of albumin. There was no diacetic acid. The pulse tension became definitely higher. Oedema and anasarca appeared in the lower limbs, trunk, and face, and later ascites developed. The administration of oxygen was started with a view to assisting in the oxygenation and metabolism of the fatty acids in the circulation. This was continued for 36 hours and was accompanied by a very pronounced improvement in the child's general condition, as on the eighth day she had quite regained consciousness, recognised her friends, and swallowed her food without the slightest resistance. Nausea and retching which had been constant disappeared. Urine was passed in greater amount, though the actual quantity could never be determined, and acetone began to be excreted in greater amount. During that day she seemed comfortable and appeared to be doing well until the evening. She became restless again and passed through a phase of excitement exactly similar to that described above. Oxygen was given again but the patient died about one hour afterwards, but not in coma as she was quite conscious a few minutes before death.

The other treatment consisted of normal saline enemata of which six ounces were given every four hours from the beginning. Later sodium bicarbonate in the strength of 2 drachms to the pint was incorporated. On two occasions 18 ounces of sodium bicarbonate and saline solution were injected subcutaneously. When milk was taken sodium citrate was given along with it, but when this was refused it was given with the brandy and water. Stimulants used were strychnine, brandy, and adrenalin. The last was dropped into the conjunctival sac and proved of some value, as the patient became much brighter and improved generally after this treatment. The effect was transitory, however.

On post-mortem examination the liver was somewhat enlarged, of light yellow colour, and on squeezing it droplets of oil exuded from the cut surface. Microscopically there was very extensive and advanced fatty infiltration but no degeneration of cell protoplasm. The kidney, in addition to some catarrhal changes, showed some fatty infiltration in the convoluted and straight tubules. The intestines were filled with altered blood and showed some congestion of the Peyer's patches. The spleen and suprarenal bodies were healthy. The heart was healthy. The lungs were quite healthy except for a partially calcified gland at the root of the right lung. As regards the brain, there was slight cedema of the pia arachnoid membranes, but otherwise the brain was

healthy. The operation wound was healthy and showed no signs of suppuration.

To summarise. On Monday, Nov. 18th, 1907, the child was operated upon and was under the anæsthetic (chloroform) for one and a half hours. The anæsthesia was followed by three days of apathy and drowsiness accompanied by nausea and retching with occasional vomiting. On Thursday, the 21st, there were general jaundice and an odour of acetone in the breath. On Thursday evening restlessness, excitement, and delirium came on. Vomiting became more frequent and on this occasion the patient had hæmatemesis. Acetone odour in the breath became more perceptible. Restlessness continued till Monday morning, the 25th. On Saturday there was the coincident appearance of acetone and albumin in the urine for the first time, and from that date general oedema and anasarca appeared and increased. On Monday, the 25th, the patient became mentally much clearer and generally improved, but in the evening she relapsed into the state of excitement and died from heart failure at 1.30 A.M. on the following morning. The post-mortem changes have been described.

The special features in the case are, in the first place, the delay in the excretion of acetone in the urine, and, secondly, the unusually prolonged course of the illness. In similar cases previously recorded it has been seen, where acetone is excreted at once, or at any rate soon after the operation, that the chances of recovery are improved and that the longer the excretion is delayed the more unfavourable does the prognosis become. That acetone and its poisonous precursors were being manufactured before their excretion in the urine in any quantity was shown by the acetone odour of the breath three days before the urine contained acetone. In some cases previously recorded death has been found to occur in from 12 to 36 hours after anæsthesia, but the average duration is three or four days. This case ran an unusually prolonged course and did not terminate till seven and a half days after the onset of symptoms.

The history of cyclic vomiting prior to admission lends support to the view that cases subject to these attacks are also liable to so-called post-anæsthetic poisoning or fatty acid intoxication. What part is played by the anæsthetic in the production of these symptoms is at present not clearly understood. Similar symptoms with fatal results and similar post-mortem changes have followed anæsthesia with ether and ethyl chloride. Langmead records a case in which similar symptoms followed the administration of nitrous oxide, but this case recovered. All that can be said at present is that a general anæsthetic must interfere with fat metabolism in such a way that complete oxidation of fat does not take place and so we have the intermediate products of fat metabolism, β -oxybutyric acid and diacetic acid, passed into the circulation, giving rise to symptoms of fatty acid intoxication. Fatty liver is a constant phenomenon in all the post-mortem reports of previous cases of this sort. That some connexion exists between this and the symptoms is clear, but what the exact relationship is is in the meantime obscure.

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THREE CASES OF FRACTURE OF THE LOWER END OF THE HUMERUS.

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FRACTURES of the lower end of the humerus are of frequent occurrence in young active boys and girls and the result of ordinary expectant treatment is too often a faulty union with limitations of movement. The difficulties of getting good results by expectant treatment in many of these accidents should be well known, and the following cases bring out most of the points to which attention must be paid in dealing with this form of fracture.

CASE 1.—A boy, aged seven and a half years, whilst riding a pony on April 2nd was thrown by the pony putting its foot in a rabbit-hole. The boy pitched on his left elbow and fractured the humerus transversely at the lower end just above the olecranon fossa. He was brought to London and seen by Mr. Frank Romer who found the lower end of the bone displaced inwards and upwards and also rotated outwards; the joint was distended and there was much bruising.

An attempt was made to reduce the fracture under an anæsthetic but it was not possible to do this and both flexion and extension of the elbow-joint were greatly limited. A skiagram taken by Dr. W. Ironside Bruce showed considerable displacement of the lower fragment and emphasised the impossibility of reducing the fracture by manipulation. After a consultation with Sir Thomas Smith an operation was decided upon.

This was performed on April 16th, when an incision was made about eight centimetres long in the mid-line at the back of the arm, the mid-point of the incision being over the fracture. The muscular tissue was separated down to the fractured ends of the bone which were gradually manipulated into position and fixed by means of a staple. The wound was closed by uniting the split muscle with two or three thread sutures and the skin incision was sewn up by a sub-cuticular stitch of thread. The arm was bandaged to an anterior angular splint. The wound was dressed on the fourth day and the stitch taken out on the eighth day; at the same time the splint was taken off and the arm manipulated. The arm was exercised each day more and more and the splint left off during the day. The boy progressed rapidly and in three months was able to play all games as well as ever. When seen in October the arm could be fully extended and flexed and for all practical purposes the arm was as useful as before the accident.

CASE 2.—A boy, aged seven and a half years, fell on a tennis lawn in June, 1907, and fractured his left humerus transversely at the lower end just above the olecranon fossa. The boy was taken home and anæsthetised and the arm was "set" and put on an internal angular splint. Next day the arm was skiagraphed, after which the boy was again anæsthetised and the position of the arm changed, it being now bandaged to his body with the left hand pointing over the right shoulder. The arm was taken down 12 days later and gently moved to a right angle and then replaced. This was repeated seven days later when the arm was put into a sling. The splint was left off a week later and the arm was daily exercised and massaged, but notwithstanding the treatment at the end of six weeks the flexion and extension of the arm were extremely limited. The boy was taken to see Mr. Romer, who examined the arm, the boy being anæsthetised. It was found that on extension after the arm had passed the right angle a few degrees the joint *locked* and no further extension could be made. The arm was x-rayed by Dr. Bruce on July 24th and the radiogram showed considerable displacement *backwards* of the lower fragment in the lateral view, and considerable *lateral* displacement in the postero-lateral view.

Operation was performed by me on July 29th. The proceedings were the same as at the last operation until the bone was exposed. The fracture was found to be firmly united, but on extending the arm the inner edge of the olecranon instead of fitting into the fossa came against the inner wall and could not be further extended because of this. It was obvious that the lower fragment had been rotated inwards in this case as in the last and had united in this malposition. The bone was sawn through at the seat of fracture with a fine Gigli's saw. The lower fragment was pushed into proper position and kept there by a staple which was put in at the back of the external condyle, keeping the fragments together. Extension was then made on the forearm and it was possible to extend the arm nearly fully.

The after-treatment of this case was similar to the preceding one and the result has been equally satisfactory. The boy was last seen in November, when he could use his arm as well as before the accident. He could not touch his shoulder with his fingers, but excepting this all other movements were normal and he could play any game with ease and comfort.

CASE 3.—A girl, aged 12 years, while getting over some iron railing on Nov. 31st, 1907, fell and pitched on her left elbow. She was taken back to the house close by and attended to by Dr. A. H. Spicer. When seen next day (Dec. 1st) by Mr. A. Chune Fletcher and myself in consultation with Dr. Spicer the arm was considerably swollen but no crepitus could be obtained and the joint movements were smooth. Although there was not any positive evidence of fracture it was thought desirable to have a skiagram taken. This was done two days later, when a fracture was seen to exist just above the condyles, the lower fragment being rotated forwards, but there was no actual separation seen and no other displacement. It was decided when the swelling had gone down that the arm should be examined under an anæsthetic