course of the vein accompanied by red, swollen, and tender areas of overlying skin. It occurred in six instances and subsided rapidly. A mild infection of the incision was found seven times.

Discussion

An examination of the records of the infusions showed that by the intratibial route an average of 40 oz. (1.14 litres) of fluid was given (Table III). The duration of the infusion

TABLE III

	Intratibial	Intravenous
Total fluid given in series	2,873 oz. (81.6 l.)	3,046 oz. (86.5 l.)
Average amount given	40 " (1.14 l.)	42 " (1.2 l.)
Average time	34 hours	42 hours

was anything from 12 hours to four or five days (average 34 hours). By the intravenous route an average of 42 oz. (1.2 litres) was given, and the duration of the infusion ranged from 12 hours to three or four days (average 42 hours). It also appeared that the maximal rate of flow of the intratibial "drip" was almost as good as that of the intravenous and quite adequate for infusions at the rate we required.

In none of the cases of intratibial or intravenous infusions were embolic or septicæmic complications noted, with the exception of one case in which the patient died after an intravenous infusion and in which "agonal endocarditis" was found at necropsy.

Local oedema occurred round the site of the intratibial needle in 12 cases and round the intravenous needle in 29 cases towards the end of the infusion. In the former the cause is probably due to fluid leaking back along the needle when it has been in the bone for some time and becomes loose, while in the latter it is probable that the needle is pushed through the vein while adjustments are being made to it or the baby is being moved for nursing purposes.

The intratibial needle is more firmly held in place than the intravenous needle and became loose in only five instances, while the latter was dislodged 11 times.

It would seem that the advantages of the intratibial method are "ease and speed in introducing the needle and its firm fixation" (Behr, 1944), while, on the other hand, the intravenous method is better for blood or plasma. It was also often found to be possible to deliver fluid at a faster rate by the intravenous route, though this was seldom required.

The disadvantage of the intratibial method is the occasional osteomyelitis, as compared with the complication of thrombophlebitis or abscesses in the track of the needle in the case of the intravenous method.

By improvements in technique and by removing the needle earlier it may be possible to reduce all these complications, and it should be noted that the reports in the literature indicate that the osteomyelitis is usually amenable to treatment, since it is provided with an artificial sinus by the needle puncture (Ellison, 1944).

However, it would be best to reserve the intramedullary infusion for those occasions when, for various reasons, the technical difficulties of the intravenous method are too great for the operator.

Summary

The literature on bone-marrow infusions is briefly mentioned and the incidence of the complication of osteomyelitis is assessed (approximately 1 in 150 cases).

Seventy-two intratibial infusions are compared with the same number of intravenous infusions.

One case of osteomyelitis is reported in the intratibial series, and the intratibial method is recommended as very satisfactory for the administration of the parenteral fluid in infants when difficulty is found with the intravenous method.

My thanks are due to Dr. J. C. Blake, physician-superintendent, for his advice and permission to use the hospital records, and to my colleagues for permitting me to include their cases in the infusion series. I wish also to thank the librarian of the Royal Society of Medicine, and Miss Helen Bayne, of the Library of the New York University, Bellevue Medical Centre, for assistance with the list of references.

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Medical Memoranda

Transfixion by a Muck Fork

Accidental transfixion by a muck fork or similar tined implement is not uncommon in country districts. The following case is reported in order to stress the importance of leaving the implement *in situ* until the patient reaches hospital.

CASE REPORT

The patient, a lad of 16, was admitted to the County Infirmary, Louth, at 6 p.m. on September 19, 1949. At 5 p.m. he had fallen off a lorry load of straw on to the

points of a muck fork. When seen just after admission he was lying on his right side with the business end of the fork transfixing him from behind forwards as in the accompanying drawing. The fork was thickly coated with manure. At the

suggestion of the doctor who was called to the accident, the wooden shaft had been sawn through just above the metal, for ease of transportation.

The upper tine had missed him but the three others had passed right across the buttocks and groins. The second in series entered the left buttock as shown, passed lateral to the femur, and lay with the point just under the skin of the front of the thigh. The third in series entered the posterior surface of the left buttock, passing medial to the femur, and emerged between femoral artery and vein, with the point pushing forward the overlying skin about 2 in. (5 cm.) without piercing it. The lowest tine passed deeply across the right thigh, medial to the femur, emerged momentarily in the right groin, entered the scrotum after $\frac{1}{2}$ in. (0.6 cm.), and appeared just below the pubic ramus, protruding through the skin at the base of the penis and apparently transfixing the urethra. There was no clinical evidence of sciatic-nerve involvement and the patient's general condition was good.

The four entry holes and the two exit holes were "ringed" with gentian violet for ease of identification. Catheterization revealed no blood and the urethra was assumed to be undamaged. Under general anaesthesia (Dr. Swallow) at 7 p.m. (that is, two hours after the accident) the fork was extracted—a strong pull being required. All the puncture wounds were excised within ellipses of skin as far as the deep fascia, and the tracks were enlarged slightly and generously powdered with sulphathiazole and penicillin powder; $\frac{1}{4}$ -in. diameter drainage tubes with holes cut at $\frac{1}{2}$ -in. (1.25-cm.) intervals all along were then put into most of the length of each track. The patient received 6,000 I.U. of tetanus antitoxin and 2 ml. of polyvalent gas-gangrene antitoxin pre-operatively. The tetanus antitoxin was repeated on the third day and the A.G.G.S. on the third and sixth days. He received 1 ml. of tetanus toxoid on the seventh day. Procaine penicillin, 600,000 I.U., was administered twice daily for seven days. The bacteriological report on the manure removed from the implement was as follows: "Culture—a proteolytic anaerobe morphologically typical of *Clostridium tetani* was cultured."

Convalescence was uninterrupted. The tubes were removed on the fourth post-operative day, and secondary closure of the wounds was made on the 15th day. The patient was discharged from hospital with all wounds healed on the 36th day.

Not a single drop of blood escaped until the fork was withdrawn, when the entry holes bled briskly. If a tine had entered the femoral artery or other large vessel, premature withdrawal would have complicated the issue by probably producing internal haemorrhage. Had some well-intentioned person removed the fork before admission to hospital the difficulties of visualizing each track and its relation to important structures would have been greatly increased.

My thanks are due to Mr. N. J. Nicholson, consulting surgeon to this hospital, for permission to publish this case and for advice; to Dr. W. J. Mozdierz for his assistance; and to Nurse Pope for the drawing.

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Chronic Myeloid Leukaemia and Pregnancy

The association between chronic myeloid leukaemia and pregnancy is rare. McGoldrick and Lapp (1943), in an exhaustive review of world literature (94 references), could find only 41 substantiated cases for statistical use. They quote a maternal mortality of 36.5% and a foetal mortality of 16.4%. Li, McBride, and Mettier (1947) recorded four cases and Williams (1948) a further seven cases, with a maternal mortality of *nil*, bringing the total up to date, of this variety of leukaemia, to 52.

CASE REPORT

A woman aged 25 was first seen at hospital on June 23, 1947, complaining of swellings of the legs. On examination these swellings were seen to be subcutaneous haemorrhages and the spleen was found to be enlarged, extending for 10 in. (25 cm.) below the xiphisternum. The blood count was: haemoglobin, 67%; red cells, 3,200,000; colour index, 1.04; platelets, 84,000; white cells, 188,800. The diagnosis of chronic myeloid leukaemia was established. She was admitted to hospital and treatment with urethane was begun. During the remainder of 1947 and 1948 she continued to work, and the white cell count was kept under control with urethane.

On November 9, 1948, her blood count showed the haemoglobin to be 72% and the red cells 2,950,000, but the white cells had risen to 202,000. She was referred to the radiotherapy department for x-ray treatment of the spleen, which reached to the iliac crest and almost to the midline. From December 15 to January 19, 1949, a total of 900 r to the skin over the spleen was given, reducing the white count to 6,800. The blood count on April 25, 1949, was: haemoglobin, 62%; white cells, 8,200.

On July 8 she was referred for a gynaecological opinion as she had noticed a swelling of the lower abdomen; she was otherwise symptom-free and was at work in a factory. On examination the uterus was found to be the size of a 28-weeks pregnancy and the foetal heart could be heard; the spleen was palpable, extending for 4 in. (10 cm.) below the costal margin. The patient, still unmarried, did not know she was pregnant and could only give the date of her last menstrual period as some time in January. The blood count on July 11 was: haemoglobin, 60%; red cells, 3,620,000; white cells, 33,200. No myeloblasts were seen.

On September 19, with a normal delivery, she gave birth to a living female infant weighing 6 lb. 12 oz. (3.1 kg.). The placenta was expelled with a total blood loss of only 8 oz. (230 ml.). The placenta contained numerous infarcts. The infant, which appeared to be a full-term child, had a spina bifida and myelocoele extending for 3 in. (7.5 cm.) over the lumbar region associated with a spastic paraplegia. The infant's blood count was: haemoglobin, 128%; red cells, 6,350,000; white cells, 10,400 (polymorphs 60%, lymphocytes 30%, monocytes 10%). The baby died on September 26.

Post-mortem Report (Dr. A. J. McCall).—The body was that of a female infant apparently full-term with a swelling over the sacrum about 2 by 3 in. (5 by 7.5 cm.) in diameter. The skull was normal except for an unusually large gap between the two frontal bones. There was intense engorgement of the leptomeninges, and the cerebrospinal fluid in the ventricles was obviously purulent. Examination of the pus revealed numerous *Bacterium coli*. The lungs were congested and oedematous. There was a defect in the lower lumbar and sacral vertebrae due to spina bifida. The skin over the swelling had not ulcerated but the cavity contained pus. Histological sections from the lung, kidney, suprarenals, liver, spleen, and one rib showed no evidence of leukaemia. Death was due to *Bact. coli* meningitis from infection of a spina bifida.

The puerperium was uneventful and involution satisfactory. The mother's blood count on September 21 was: haemoglobin, 54%; red cells, 3,840,000; white cells, 74,000. On September 27 it was: haemoglobin, 62%; red cells, 3,410,000; white cells, 110,000. Moderate hypochromasia, anocytosis, and poikilocytosis were present. There were over 600 normoblasts for every million red cells, and rare myeloblasts were found. She remained symptom-free and returned to work.

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