diaphragm. There was an ulcer on this portion, from which she later had a large haematemesis. This condition had, of course, no relation to her asthma, but the case serves to illustrate how important coincidental conditions sometimes come to light in the course of a routine investigation (see Fig. 3).

The other two cases, both young adults with incessant asthma since infancy, showed recurrent evanescent shadows in different situations on their chest radiographs during a follow-up period of over four years. One patient subsequently twice developed pulmonary abscesses, which she spontaneously evacuated, and material sucked from the infected area through a bronchoscope grew a *Streptococcus viridans*. The other patient also at one time developed a small abscess cavity with a fluid level, which quickly disappeared spontaneously. In neither case did the blood eosinophils ever exceed 6% (see Fig. 4).

Transitory opacities seen in the chest radiographs of asthmatics, such as occurred in the last two cases, have been described by many authors—for example, Peshkin (1927) and Sédillot (1934). There has been considerable speculation about their nature, particularly whether they are caused by localized areas of infection or by eosinophilic infiltration. The character of these two cases suggests that infection is the cause in some of them.

Summary and Conclusions

A review of the radiological findings in 200 cases of asthma, 100 children and 100 adults, is presented, and an attempt made to correlate the x-ray appearances with clinical findings. The series consists of typical cases of asthma, seen as out-patients only.

Sinus radiographs show changes in over half the cases, there being a higher proportion with marked abnormality in the children than in the adults.

Chest radiographs, disregarding minor abnormalities, fall into five groups: normal, emphysema, emphysema and increased hilar shadows, increased hilar shadows, and other important abnormality. The last group includes cases of pulmonary tuberculosis, segmental collapse, and recurrent transient shadows believed to be due to localized areas of infection.

In attempting to distinguish between irreversible emphysema and pulmonary distension due to the bronchiolar obstruction of asthma, the value of radiographs taken in full inspiration and full expiration, and of comparing one taken in expiration with a normal control, is stressed.

Emphysema is the commonest complication, and is judged to be present in 28 children and 46 adults. The evidence suggests that both chronicity and infection are important factors in its development.

Enlarged hilar shadows are present in a higher proportion of the infective than of the non-infective cases. Segmental collapse, with subsequent satisfactory re-expansion, is present in 4%, and is seen in both infective and non-infective types. Active pulmonary tuberculosis is found in 1.5%.

In conclusion it should be pointed out that the chest radiograph in uncomplicated asthma is normal, but that a great deal of help can be obtained from radiography in the diagnosis of complications, in the elucidation of the aetiology, and in the discovery of coincidental conditions.

I should like to express my thanks to Drs. C. N. Pulvertaft and R. A. Ashwin, consultant radiologists to the County and City General Hospitals, York, whose co-operation and assistance with the radiological diagnosis have made this investigation possible.

REFERENCES

- Bray, G. W. (1930). *Arch. Dis. Childh.*, 5, 252.
 Bullen, S. S. (1933). *J. Allergy*, 4, 402.
 Chapman, J., and Hoskins, H. (1941). *Amer. Rev. Tuberc.*, 43, 512.
 Clarke, J. A. (1930). *Arch. intern. Med.*, 45, 624.
 Friedman, T. B., and Molony, C. J. (1939). *Amer. J. Dis. Child.*, 58, 237.
 Grove, R. C., and Cooke, R. A. (1933). *Arch. Otolaryng.*, 18, 622.
 Kern, R. A., and Schenck, H. P. (1929). *Amer. J. med. Sci.*, 178, 168.
 Lapage, C. P. (1922). *British Medical Journal*, 2, 1267.
 Manges, W. F., and Hawley, S. J. (1927). *J. Amer. med. Ass.*, 89, 870.
 Maxwell, J. (1937). *St. Bart's Hosp. Rep.*, 70, 187.
 Peshkin, M. M. (1927). *Amer. J. Dis. Child.*, 33, 880.
 Sédillot, J. (1934). *Bull. Soc. Méd. Paris*, 138, 573.
 Unger, L. (1945). *Bronchial Asthma*, p. 259. Springfield, Illinois.

THE TREATMENT OF RECENT TRANSCERVICAL FRACTURES OF FEMUR

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Much has been written on this subject during the past 20 years, and our only excuse for adding to the literature is that we have evolved a simple method of treating these injuries, the results of which seem to compare favourably with those of any other method so far described.

It is now generally agreed that the treatment of choice in transcervical fractures of the femur, particularly those of the adduction type, is some form of nailing operation, with or without a bone graft according to the nature and age of the fracture; and our treatment is based on the internal fixation operation originally described by Smith-Petersen *et al.* in 1931. During the past four years rather more than 100 such operations have been carried out, and we wish to describe the management and the results in a consecutive series of 100 cases in which the end-result is clear. The number of patients involved was 98, two of them having the second hip nailed a few months after the first. The great majority of them were women, the injury being much less common in men.

Selection and Management of Cases

Abduction fractures with impaction are excluded from this series, it being unnecessary to operate on most of them. Apart from these, all the cases admitted with adduction fractures of the femoral neck have been included, and were subjected to operation unless they were moribund or were suffering from advanced senile mental changes. Indeed, several cases from a neighbouring mental hospital have been successfully treated.

Unlike Bankart (1942), who advocated that few patients over the age of 80 should be operated upon, we have not made age alone a bar to operation. The average age in this series was 73, and the range extended from 44 to 93, 60% of them being in the age group 71-85.

On admission all patients are subjected to a full clinical examination and radiographs are taken of the injured hip to determine the nature of the fracture. The patient is then put to bed and a simple form of skin traction is applied to the injured leg by means of extension strapping applied below the knee. The usual weight employed is 9 lb. (4 kg.), which is connected to the strapping by means of a cord passing over a pulley attached to the lower bed-rail. This simple form of traction does not immobilize the

fracture, but it has the merit of preventing, or correcting, any gross shortening. It also steadies the limb, thus relieving the patient of a considerable amount of pain.

Should the general examination reveal the presence of moist sounds at the lung bases, penicillin is given in the form of its procaine salt, 300,000 units daily; and in all cases breathing exercises are begun under the direction of a physiotherapist. A simple explanation is also given of the patient's post-operative management, and foot drill is initiated. In most cases no other pre-operative measures are carried out, but should a patient be suffering from diabetes mellitus this is stabilized as rapidly as possible. None of the resuscitative measures described by some surgeons (Harmon, 1945), such as blood transfusion, have been found to be necessary. As soon as a suitable opportunity occurs the patient is operated upon, and this is usually carried out within a few days of the injury.

The Operation

Here again simplicity has been our keynote, and all direction-finding aids have been discarded except one—namely, the hinged gauge (London Splint Co.). All patients have been given a general anaesthetic, usually thiopentone, gas-oxygen, and "trilene," with D-tubocurarine or similar drug, and the operation is nearly always completed well within an hour.

A slightly modified fracture table is employed, a padded wooden platform being fitted in place of the usual small sacral rest. Beneath the platform is a slot into which cassettes can be inserted without disturbing the position of the patient.

The patient is placed upon the table and enough traction put on the uninjured limb to steady the pelvis. The injured limb is then manipulated by hand into a position of abduction and internal rotation and enough traction applied to render the limb just taut. In nearly all cases these simple manoeuvres are sufficient to ensure full and accurate reduction of the fracture.

As Van Gorder (1948) and others have already mentioned, a bony spike attached to the inferior border of the femoral head may make accurate reduction difficult, and it may be shown that further manipulation is necessary after the initial x-ray films are developed.

Two portable x-ray units are then placed in position and the hinged gauge is attached to the front of the hip with strapping in such a position that the hinge lies just below the anterior-superior iliac spine; one limb lies in the groin crease and the other lies in the line of the femoral shaft. After the first films are developed, the accuracy of the reduction is checked, and from the superimposed image of the gauge in the antero-posterior film two points can be marked on the skin with methylene blue which, when joined, will show the correct line for the nail in the horizontal plane. The correct line for the nail in the vertical plane is taken as being parallel with the floor, with, if anything, a slight posterior tilt.

It has been our aim to insert the nail at a slightly more oblique angle to the shaft than the long axis of the femoral neck, as advocated by Bankart (1942), thus converting shearing forces at the fracture site, especially in those cases corresponding to Pauwel's (1935) group 3, to impacting forces. We also try to complete the operation with the nail lying slightly behind and below the long axis of the neck, and with its tip coming to rest just beneath the articular surface of the head. With the nail so placed, there is much less danger that it will cut out if the femoral head undergoes avascular necrosis or if the capital fragment is very small.

With these aims in mind the operation is proceeded with in the usual way, the guide-wire being inserted well into the head fragment to prevent rotation while the nail is being hammered in. We have no objection to the guide-wire perforating the articular cartilage of the head, but do not make a point of pushing it right through into the pelvis, thus completely transfixing the head, as described by Bankart. The guide-wire is of known length, and the correct size of

nail can be determined by measuring the length of guide-wire protruding from the lateral cortex of the femur. The nail is hammered in over the wire, without the preliminary use of a starter. The wire is withdrawn, traction on the limb is slackened, and the fragments are impacted with a few blows from the mallet.

The wound is then closed, no additional measures, such as the insertion of cross-pins, being taken to prevent the nail from sliding out during convalescence. There are two reasons for omitting this step. The first is that if the nail should become loose enough to allow lateral extrusion the anchoring cross-pin will probably loosen also. The second is that complete prevention of lateral sliding is apt to cause slight separation of the bony fragments due to the bony absorption that occurs about any fracture during the early stages of healing, and therefore gives rise to delayed union or non-union.

Post-operative Care

Various methods of restricting external rotation of the injured limb after operation have been tried and discarded. As a routine measure we now use the abduction frame designed by McLean (1949). This frame prevents external rotation and adduction of the limb while permitting flexion and extension of the knee- and hip-joints. It also acts as a bed-cradle, thus relieving the legs of the weight of the bedclothes.

The day after operation active exercises under the direction of a physiotherapist are begun, all movements of the hip, knee, and ankle being permitted except external rotation and adduction of the hip-joint.

At the end of one month a radiograph of the injured hip is taken, and if the position of the nail and of the bony fragments has been maintained the patient is allowed up daily for non-weight-bearing exercises on crutches. Further x-ray films are taken at intervals of a month, and, provided that there is radiological evidence of bony union, graduated weight-bearing exercises are begun at the end of three months. If union has not occurred, or its degree is doubtful, weight-bearing is postponed until it is definitely present, and this may mean a delay of six months or more in some cases.

Provided home conditions are satisfactory and the general condition of the patients is good, they are discharged from hospital when they have learnt to manage crutches. Most of our cases, however, have remained in hospital for the full three months, principally because they lived alone.

Results of Treatment

In view of the fact that the nailing operation has been carried out in every case unless it was obvious that the patient was moribund on admission, we believe our results compare favourably with most of those published to date. A few surgeons have achieved a higher percentage of union, but they have usually been on a smaller series of cases and a more careful selection has been made, thus lessening the risk of failure.

In our series of 100 operations, union has been achieved in 75, with one death attributable to the operation. This death occurred in a woman, aged 85, 24 hours after operation. Altogether nine patients died while under treatment, but in eight death did not occur until several weeks or months after operation, and in none of them could the cause be related to the operation. The full results are summarized below.

No. of patients	..	98
No. of operations	..	100 (bilateral in two patients, aged 66 and 78)
Average age	..	73 (range 44-93)
No. united	..	75
No. ununited but ambulant	..	10 (7 with and 3 without callipers)
No. of nails removed	..	4 (1 had united)
Incidence of wound sepsis	..	Nil
Deaths while under treatment	..	9

Causes of death:

- 1 operative shock, aged 85
- 1 cerebral arteriosclerosis (senility), aged 81
- 2 myocardial degeneration, aged 80
- 1 pulmonary embolism, aged 74
- 1 acute gastro-enteritis and cardiac failure, aged 79
- 1 coronary thrombosis, aged 75
- 2 hypostatic pneumonia, aged 74 and 76.

Summary

A simple method of treating adduction fractures, and abduction fractures which have disimpacted, of the femoral neck is described. The results appear to be satisfactory according to modern standards. Bone grafting was not carried out in any case.

In those cases in which the nailing operation failed, further surgical intervention was not undertaken because of the age of the patients and their general condition.

We are indebted to Sister Pinfield, the sister of the ward in which most of these patients were treated; to our anaesthetist, Dr. R. E. Gibson; and to Miss Savin and her all-too-small band of physiotherapists for any success we may have achieved in the management of this series of fractures.

REFERENCES

- Bankart, A. S. Blundell (1942). *Lancet*, 1, 249.
 Harmon, Paul, H. (1945). *J. Bone Jt Surg.*, 27, 128.
 McLean, E. K. (1949). *British Medical Journal*, 2, 754.
 Pauwels, F. (1935). *Der Schenkelhalsbruch: ein mechanisches Problem*. Stuttgart.
 Smith-Petersen, M. N., et al. (1931). *Arch. Surg., Chicago*, 23, 715.
 Van Gorder, G. W. (1948). *J. Amer. med. Ass.*, 137, 1181.

ADDENDUM.—Since this paper was written one more case must be listed as a failure. Thus the percentage of successful cases in this series is 74.

THE KAHN TUBE TEST WITH DROPPING-PIPETTES

BY

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In recent years many laboratories have abandoned the Wassermann test and substituted the Kahn standard tube flocculation test as being superior to complement-fixation methods. The belief that the Kahn test gives more false positive results than the Wassermann has been seriously challenged by Berger and Sutherland (1944). But though the Kahn method is relatively simple, in performance it is exacting, especially in the measurement of small volumes of antigen in graduated pipettes. This disadvantage can be largely overcome, and the test set up more rapidly, by the use of pipettes standardized to deliver drops of known volume. Such pipettes have already been advocated in other serological tests for the diagnosis of syphilis—for example, in the Wassermann reaction (Donald, 1916), the sigma reaction (Dreyer and Ward, 1921), and in slide flocculation tests (Mazzini, 1942; Gradwohl, 1943; Harris et al., 1948).

As regards the Kahn test, the volumes of reagents used are economical and the smallest practicable for volumetric work in test-tubes. Osmond (1940) used a dropping-pipette to deliver the standard 0.0125 ml. of antigen suspension. He recommended a pipette with a tip diameter equivalent to No. 54 on the Morse scale (1.397 mm., or 0.055 in.).

Two pipettes are described below—one for the delivery of 0.0125-ml. volumes of antigen, the other for 0.15-ml. volumes of the patient's serum.

Dropping-pipette for Antigen

30-cm. lengths of 7-mm. soft glass tubing are drawn to make two pipettes. The tip diameter is found by thrusting the capillary portion into the No. 55 Morse gauge hole

(1.321 mm.) of a Starrett plate and cutting the tube at the point where it jams in the hole. When cut the capillary portion should be about 6 cm. long, with sides nearly parallel for the last 4 cm. The external diameter of the tip, which should be 1.30 mm. (0.051 in.), is checked by a micrometer screw gauge, making two measurements at right-angles to one another. It is useful at this stage to mark the capillary shaft with waterproof ink exactly 1 cm. from the tip, so that after cleaning, etc., pipettes with broken tips may be readily recognized and discarded.

The correct diameter (1.30 mm.) was arrived at as follows. A pipette was calibrated with mercury to contain 1 ml., and the weight of 1 ml. of antigen suspension was found to be 0.91 g. Weighed 0.91-g. amounts of the antigen suspensions were then drawn into dropping-pipettes of different tip diameter to determine which delivered 80 drops to the ml.—that is, 0.0125 ml. per drop. (A 1.397-mm. pipette (Osmond, 1940) was found to deliver 77 drops to the ml.)

This volume is delivered in one drop when the rate of dropping is one per second from a vertically held pipette. But even with care in maintaining an even rate of dropping there is some variation in the size of the drop. It was not possible, however, to minimize the error by delivering the same volume of liquid in a number of smaller drops. Thus to deliver two drops of half the required volume (0.00625 ml.) a tip diameter of 0.62 mm. was necessary, and capillary shafts of this size are too fragile for routine use.

Compared with 0.1-ml. graduated pipettes, marked to deliver 0.0125-ml. volumes, the dropping-pipette is much quicker and easier to use. In a two-tube test, one receiving one drop (0.0125-ml.) and the other two drops (0.025 ml.), it took about four minutes to dispense antigen suspension for 100 tests. With graduated pipettes the same operation took 22 minutes. The dropping-pipette technique is readily acquired by the laboratory technician, whereas the use of graduated pipettes demands more experience and entails much more eye strain.

Dropping-pipette for Patient's Serum

The Kahn standard test requires the delivery of 0.15-ml. volumes of serum. The weight of 1 ml. of a pool of five inactivated human sera proved to be 1.02 g. Of this pool 0.918-g. amounts (0.9 ml.—that is, six 0.15-ml. drops) were tested in pipettes of different tip diameters, with the following results:

Tip Diameter (mm.)	No. of Drops in 0.9 ml.	0.15 ml.
2.8	18	3
5.0	12	2
9.3	6	1

Only the results with pipettes delivering simple fractions of 0.15 ml. are cited above. The 2.8-mm. diameter was selected because in practice the variation in volume is less when the 0.15 ml. is delivered in three drops than in two or one.

With this 2.8-mm. pipette, delivering 0.15 ml. of serum in three drops (0.05 ml. of serum per drop) at the rate of one drop per second, 100 sera could be dispensed, each in three 0.15-ml. volumes and with a triple rinse of the pipette in saline for each serum, in 33 minutes. With a graduated 1-ml. pipette, similarly rinsed for each serum, the same operation took 45 minutes.

The Kahn Test with Dropping-pipettes

Apart from the saving of time and labour in the performance of the test, and the ease with which accurate dropping-pipettes can be constructed by a competent laboratory technician, the dropping-pipette technique permits a modification that is useful, especially when the test is done in hot climates. In the standard test the antigen suspension is dispensed first, and when large numbers of sera are to be tested there is a real risk of evaporation of the smallest dose (0.0125 ml.) of liquid. Serum is added to antigen, and not vice versa, presumably because the antigen pipette might