delayed pentobarbitone absorption in rats and attributed this to retarded gastric emptying. Therapeutic doses of aluminium hydroxide, however, had no significant effect on paracetamol absorption in six healthy volunteers. If anything, absorption was more rapid after the antacid (J. Reid and J. Nimmo, unpublished observations, 1973). Like atropine, propantheline has inhibitory effects on the motor activity of the stomach and small intestine and delays the absorption of riboflavin (Levy *et al.*, 1972). Similarly, atropine delays the absorption of orally administered lignocaine (Adjepon-Yamoah *et al.*, 1973) and tricyclic antidepressants slow down the absorption of phenylbutazone (Consolo *et al.*, 1970).

In the present study propantheline markedly reduced the rate of gastric emptying and the absorption of paracetamol was significantly delayed as judged by plasma concentrations and urinary excretion of the drug. Propantheline did not alter the total amount of drug excreted in 24 hours and probably did not alter the total amount absorbed. On the other hand, metoclopramide increases gastric peristalsis and relaxes the pyloric canal thus shortening the gastric emptying time (James and Hume, 1968; Howarth *et al.*, 1969). The rate of paracetamol absorption was correspondingly increased. Propantheline and metoclopramide were given at times likely to produce maximum effects on paracetamol absorption on the basis of their expected duration of action. Further studies are required to establish the effect of varying the time interval between administration of paracetamol and propantheline or metoclopramide.

Drug-induced changes in the rate of gastric emptying should have therapeutic significance if rapid absorption is required or if toxicity is associated with high drug plasma concentrations. The important role of gastric emptying in the absorption of orally administered drugs has other clinical implications. We have observed grossly impaired paracetamol absorption in patients with gastric stasis due to pyloric stenosis, and in such patients

drugs should probably be given parenterally rather than by mouth.

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References

- Adjepon-Yamoah, K. K., Scott, D. B., and Prescott, L. F. (1973). *British Journal of Anaesthesia*. In press.
- Brodie, B. B. (1964). In *Absorption and Distribution of Drugs*, ed. T. B. Binns, p. 16. Baltimore, Williams and Wilkins.
- Consolo, S., Morselli, P. L., Zacala, M., and Garratini, S. (1970). *European Journal of Pharmacology*, 10, 239.
- Heading, R. C., Tothill, P., Laidlaw, A. J., and Shearman, D. J. C. (1971). *Gut*, 12, 611.
- Heading, R. C., Nimmo, J., Tothill, P., and Prescott, L. F. (1973). *British Journal of Pharmacology*. In press.
- Hogben, C. A. M., Schanker, L. S., Tocco, D. J., and Brodie, B. B. (1957). *Journal of Pharmacology and Experimental Therapeutics*, 120, 540.
- Howarth, F. H., Cockel, R., Roper, B. W., and Hawkins, C. F. (1969). *Clinical Radiology*, 20, 294.
- Hunt, J. N. (1958). In *Modern Trends in Gastroenterology*, ed. F. Avery-Jones, p. 163. London, Butterworth.
- Hurwitz, A., and Sheenan, M. B. (1971). *Journal of Pharmacology and Experimental Therapeutics*, 179, 124.
- James, W. B., and Hume, R. (1968). *Gut*, 9, 203.
- Kekki, M. *et al.* (1971). *International Journal of Clinical Pharmacology*, 5, 209.
- Kojima, S., Smith, R. B., and Doluisio, J. T. (1971). *Journal of Pharmaceutical Sciences*, 60, 1639.
- Levine, R. R. (1970). *American Journal of Digestive Diseases*, 15, 171.
- Levy, G., and Jusko, W. J. (1965). *Journal of Pharmaceutical Sciences*, 54, 219.
- Levy, G., Gibaldi, M., and Procknal, J. A. (1972). *Journal of Pharmaceutical Sciences*, 61, 798.
- Magnussen, M. P. (1968). *Acta Pharmacologica et Toxicologica*, 26, 130.
- Prescott, L. F. (1971). *Journal of Pharmacy and Pharmacology*, 23, 807.
- Prescott, L. F., and Nimmo, J. (1971). *Acta Pharmacologica et Toxicologica* 29, Suppl. No. 3, p. 288.
- Schanker, L. S., Shore, P. A., Brodie, B. B., and Hogben, C. A. M. (1957). *Journal of Pharmacology and Experimental Therapeutics*, 120, 528.
- Siurala, M., Mustala, O., and Jussila, J. (1969). *Scandinavian Journal of Gastroenterology*, 4, 269.

PRELIMINARY COMMUNICATIONS

Treatment of Chondromalacia Patellae by Transposition of the Tibial Tubercle

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Summary

The first 20 patients treated by transposition of the tibial tubercle for chondromalacia of the patella are reported. The patients, usually adolescent girls, had failed to respond to conservative measures. Seventeen patients benefited from the operation and three did not.

Introduction

Chondromalacia of the patella is a common and disabling condition of uncertain aetiology and unpredictable natural history. It often presents in adolescent girls keen on sport, in whom

conservative treatment including restriction of activity, non-resistant knee exercises, short-wave diathermy, and plaster immobilization often fails (Wiles *et al.*, 1956). Drilling or shaving of the patellar cartilage occasionally gives a good result for a localized lesion but in general has been discarded (Wiles *et al.*, 1960; Duthie and Hutchinson, 1958). The removal of an abnormally high ridge on the medial femoral condyle which is present in some cases has been advised by Outerbridge (1961). Excision of the patella, although it may get rid of the symptoms of the chondromalacia, is too drastic for an athlete (Cave and Rowe, 1950).

The treatment of chondromalacia of the patella by transposition of the tibial tubercle has been successful in the adolescent, and the method and early results are given here.

Clinical Findings

Pain, stiffness, and intermittent swelling of the knee with a feeling of insecurity or "catching" were the usual complaints. True locking or giving way of the knee so that the patient fell to the ground was not seen.

All the patients suffered pain on pressing and manipulating the patella against the femur; the undersurface of the patella was always tender to the pressure of the palpating finger (Devas, 1960). Some patients had scars from previous menisectomies.

Failure to relieve symptoms by conservative measures over some four to six months was the usual indication for tibial tubercle transposition. A few patients were over 20 years of age at the time of the operation.

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Details of the patients, the results, and the length of follow-up are given in table I.

TABLE I—Details of Results in 20 Patients under Study

Case No.	Age	Sex	Length of History	Result and Time in which Achieved (Months)	Persisting Complaints	Present Activities or Sport	Length of Follow-up (Years)
1	14	F.	14 months	Good, 6	—	—	7
2	15	F.	8½ months	Good, 6	—	Housewife	5
3	19	F.	5 months	Good, 4	—	Housewife	4½
4	15	F.	4 months	Fair, 3	"Can't kneel"	Dancer	4
5	15	F.	3 years	Good, 5	Flexion to 140	—	3½
6	16	F.	11 months	Bad, —	Pain. Catching	—	3
7	19	F.	15 months	Good, 4	—	Mountain climbing	3
8	15	M.	6 months	Good, 4	Numbness upper shin	Football	2
9	19	M.	6 months	Fair, 5	Pain and catching and instability	Football	2
10	15	F.	2 months	Bad, —	"Can't kneel"	Dancer	2
11	14	F.	2 years	Fair, 11	—	School sport	2
12	25	M.	6 years	Good, 8	Some instability	Football	2
13	32	M.	Over 6 years	Fair, 6	—	—	2
14	14	F.	8 months	Bad, —	Locking, pain, and painful scar	Nursing	2
15	18	F.	2 years	Good, 13	—	Tennis, Nursing	1½
16	16	F.	10 months	Fair, 6	"Can't kneel." Numb over patella	Dancer	1½
17	33	F.	3 years	Fair, 5	"Can't kneel"	Dancer	1½
18	23	F.	4 years	Good, 4	Slight numbness	Nursing	1½
19	20	M.	2 years	Fair, 6	Ache after running and walking	Football	1½
20	24	F.	6 months	Fair, 6	Pain on kneeling	Housewife	1½

In case 9 the tubercle was transposed a little too far medially, with occasional catching of the patella in full flexion which needed manual pressure to release it. The patient returned to football and full activity. In case 11 the patient had a bad fall one month after operation, which delayed recovery. One patient (case 13) also had rupture of the cruciate ligaments. There were no symptoms after operation from the chondromalacia and the transposition had improved stability. In case 15 the patient's tibial tubercle slipped after transposition (no screw had been used) and, at the second operation, a screw was used for fixation.

Technique of Operation

Through a transverse incision over the tibial tubercle the lower part of the patellar tendon and its insertion are exposed and the bony attachment of the tendon is detached from the tibial tubercle. It is then transposed into a new bed about 1 to 1.5 cm medially and slightly downwards. Fixation with a screw was found to give quicker rehabilitation and to prevent displacement of the transposed tubercle. The incision was sometimes extended upwards and laterally to inspect the knee and the undersurface of the patella. After operation, straight leg raising was urged from the next day and the patient was allowed up without weight-bearing as soon as it was achieved.

Knee exercises and weight-bearing were started a few days later, usually within a week. Full function usually returned in four to six months.

Results

Altogether, 20 consecutive patients were followed up, the shortest time being 18 months for six patients. Seventeen were seen and three returned a questionnaire. Results were classified as good, fair, or bad. The good result was in patients who had returned to full activities with no discomfort other than trivial

symptoms from the scar; the fair result was in patients who were satisfied with the result and had returned to full activity and sport but with slightly persistent discomfort or disability; and patients with a bad result had no improvement (tables I and II).

TABLE II—Results of Transposition in 20 Patients

Category	Assessment	No. of Patients
Good	Full normal activities	9
Fair	Satisfied patient, some symptoms	8
Bad	No better	3

Bad Results.—There were three failures. In case 10 the patient had previously had a moderately severe twisting injury and still suffered from cruciate instability. At the time of transportation her knee was explored and a loose body removed. Two patients (cases 6 and 14) at first responded well to operation and, after about six to seven months, returned to normal activity. However, after a further three and five months respectively each developed pain, particularly under the lateral aspect of the patella.

Fair Results.—There were eight fair results. All patients returned to their favourite sports and activities but had some remaining discomfort. All but one had pain when kneeling related to the scar. Some admitted, but did not volunteer, information of having numbness in the distribution of infrapatellar branch of the saphenous nerve. All thought the operation had been worthwhile.

Good Results.—The only complaint accepted when classifying the result as good (nine patients) was the numbness. It is interesting that patients with a good result after operation, not having other complaints, volunteered this information much more readily.

Discussion

Tibial tubercle transplantation was done as a last resort for chondromalacia of the patella which had failed to respond to conservative treatment over a long period of time. Most of the patients were adolescents or young adults and were withheld from the normal sport and activities of youth by the severity of the pain. The importance of the correct alignment of the extensor apparatus of the knee in the aetiology of chondromalacia has been increasingly recognized by a number of authors. However, the method by which the correction is obtained varies. J. G. P. Williams (personal communication, 1972) used intensive physiotherapy specifically to develop the vastus medialis. Most methods of treating recurrent dislocation of the patella have been used for the treatment of chondromalacia with moderate but varying success. This is not surprising because chondromalacia often occurs in patellae subjected to recurrent dislocation (Heywood, 1961), and also the chondromalacia is not necessarily a result of injury caused by the episodes of dislocation (McNab, 1952).

Articular cartilage consists of collagen fibres embedded in the ground substance, both produced by the chondrocytes. The hardness and the resilience of the cartilage depends on the amount of sulphated mucopolysaccharides (Matthews, 1953) and on the collagen fibres being arranged by the forces acting on the cartilage (Kempson *et al.*, 1968). When the contact between the articular surfaces is poor or sporadic the collagen fibres are disarranged, permitting local surface deformities when the tension is applied and causing damage to the underlying chondrocytes. The metabolic activities and the nutritional requirements of the damaged cells increase (Collins and McElligott, 1960, Meachim, 1964), and the resulting effusion interferes with the transfer of nutrients (Maroudas *et al.*, 1968). Once the articular cartilage develops a defect the interruption of transmission of tension

forces predisposes the adjacent areas to the breakdown of the cartilage (Bullough and Goodfellow, 1968).

The medial patellar cartilage is particularly susceptible to chondromalacia, being among the thickest in the body and making a poor contact with the opposite articular cartilage. Girls are mostly affected perhaps because of the nature of their sport, perhaps because of relative underdevelopment of the vastus medialis (Williams, 1971), and perhaps because the wider pelvis predisposes to valgus position of the knees.

Transposition of the tibial tubercle compares well to excision of the patella because, although the latter relieves the symptoms of chondromalacia, it does not leave a normal knee—especially in the adolescent, at which age to be supreme in sport the kneecap is a necessity whereas in later life it is not. Quadriceps weakness, knee instability, or disabling restriction of flexion were not encountered after the operation. A total of 17 out of 20 patients found the operation valuable and returned to their normal activities and sport.

References

- Bullough, P. G., and Goodfellow, J. W. (1968). *Journal of Bone and Joint Surgery*, **50B**, 852.
 Cave, E. F., and Rowe, C. R. (1950). *Journal of Bone and Joint Surgery*, **32A**, 542.
 Collins, D. H., and McElligott, T. F. (1960). *Annals of the Rheumatic Diseases*, **19**, 318.
 Devas, M. B. (1960). *Clinical Orthopaedics*, **18**, 54.
 Duthie, H. L., and Hutchinson, J. R. (1958). *Journal of Bone and Joint Surgery*, **40B**, 75.
 Heywood, A. W. B. (1961). *Journal of Bone and Joint Surgery*, **43B**, 508.
 Kempson, G. E., Freeman, M. A. R., and Swanson, S. A. V. (1968). *Nature*, **220**, 1127.
 MacNab, I. (1952). *Journal of Bone and Joint Surgery*, **34A**, 975.
 Maroudas, A., Bullough, P. G., Swanson, S. A. V., and Freeman, M. A. R. (1968). *Journal of Bone and Joint Surgery*, **50B**, 166.
 Matthews, B. F. (1953). *British Medical Journal*, **2**, 660.
 Meachim, G. (1964). *Annals of the Rheumatic Diseases*, **23**, 372.
 Outerbridge, R. E. (1961). *Journal of Bone and Joint Surgery*, **43B**, 752.
 Wiles, P., Andrews, P. S., and Devas, M. B. (1956). *Journal of Bone and Joint Surgery*, **38B**, 95.
 Wiles, P., Andrews, P. S., and Bremnar, R. A. (1960). *Journal of Bone and Joint Surgery*, **42B**, 651.
 Williams, J. G. P. (1971). *Proceedings of the Royal Society of Medicine*, **64**, 640.

MEDICAL MEMORANDA

Persistent Haemagglutination for Infectious Mononucleosis in Rheumatoid Arthritis

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A case of persistent positive haemagglutination data for infectious mononucleosis in a patient with rheumatoid arthritis is reported. The haemagglutination data including rapid slide tests as well as antibodies to Epstein-Barr (EB) virus-induced antigens showed little change over a 12-month period.

Tube differential absorption tests with either sheep or horse erythrocytes were performed by standard methods (Lee *et al.*, 1968a; 1968b). In determining end-points the microscope was used to confirm marginal macroscopic agglutination. Antibodies to EB virus-induced antigens were measured by indirect immunofluorescence techniques (Henle *et al.*, 1968; 1971a; 1971b).

Case History

A 39-year-old woman with documented rheumatoid arthritis was followed up over a 12-month period. Infectious mononucleosis had been diagnosed at age 18. During the present 12-month period the latex rheumatoid factor titre varied between 1/640-1/1,280, while the Rose-Waaler test remained negative. The symptoms were well controlled with aspirin and limited physical therapy.

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The initial specimen was collected as a control for an infectious mononucleosis study and this and subsequent specimens gave positive test results for the disease by rapid slide tests. Pertinent haemagglutination and EB virus antibody data are summarized in table I. Complete blood counts with each specimen failed to show abnormal-appearing lymphocytes. Lymphocytes harvested from a specimen drawn on 16 April 1972 showed a normal response to phytohaemagglutinin as measured by incorporation of ³H-thymidine. Serological tests for syphilis (V.D.R.L.), HBAg, HBAb, and the ox cell haemolysis test for infectious mononucleosis were negative on specimens taken on 13 July 1971, 4 February 1972, and 16 April 1972. The patient's cold agglutinins (4°C) are compared in table II with those of six selected patients with heterophil-positive infectious mononucleosis.

Comment

Despite negative clinical findings when initially examined in April 1971, a mild or even asymptomatic case of infectious mononucleosis could not be completely excluded. The absence of atypical lymphocytes in a seropositive patient does not exclude recent infectious mononucleosis, since morphological changes as well as clinical symptomatology may disappear many months before the disappearance of specific infectious mononucleosis heterophil antibodies. We believe, however, that the relatively unchanged haemagglutination data over the 12-month period represents persistent false positivity for the disease. In addition, this patient had a persistent cold agglutinin that was unusual in that it was reactive against adult O (ii) cells, but did not significantly react against cord (ii) erythrocytes.

All of the sera from this patient showed relatively high and persistent titres (1/160) of antibodies to EB viral capsid antigens. Such high and persistent anti-viral capsid antigen titres have been recorded frequently in Burkitt's lymphoma and nasopharyngeal carcinoma, less frequently in other malignancies, systemic lupus erythematosus, sarcoidosis, and occasionally in healthy blood donors (5-15%) (Henle *et al.*, 1968; 1971a; 1971b; Evans, 1971). Antibodies to EB virus-induced early antigens are detected in about 75% of cases of infectious mononucleosis depending in part on the severity of illness (Henle *et al.*, 1971a). Since these antibodies usually appear later than anti-viral capsid antigens and disappear again after a few months, they often are of diagnostic significance. Antibodies to EB virus-induced early antigens have also been detected in many patients with Burkitt's lymphoma and nasopharyngeal carcinoma and, less frequently, in other conditions, and often persist (Henle *et al.*, 1971a; 1971b).