bandage was applied in the usual way, and was reinforced by four six-inch (15 cm) plaster-of-Paris bandages that were wound round the crêpe bandage. Weight-bearing was allowed with the aid of crutches for balance on the third day, and patients were discharged on the fourth day. Physiotherapy was given only to calf muscles and chest. Plaster-of-Paris bandages were removed on the 10th day, and quadriceps exercises were then begun, either at home unaided or in the physiotherapy department.

The two groups were comparable (table I). Heavy occupations included mining (two in each group), others were labourers on building sites. All patients in the second group were discharged on the fourth day, as planned. No complications occurred. When questioned, patients in group 2 seemed to have had less discomfort than those who received traditional treatment (group 1). Indeed, five patients in group 2 had previously been managed traditionally after meniscectomy, and they unanimously preferred treatment by adequate splintage and early weight-bearing as being more comfortable and convenient. Operative findings are shown in table II.

Results

The amounts of effusion fluid, estimated on the 10th postoperative day, were similar in both groups. In group 1 effusions were small in 14 patients, moderate in 19, and large in seven. In group 2 amounts of fluid were small in 13, moderate in 23, and large in four. The average times before patients could return to work and resume sporting activities were $8.8 \pm \text{SD } 3.6$ weeks and 13.5 ± 5.3 weeks respectively in group 1, and 7.7 ± 2.6 weeks and 10.5 ± 3.0 weeks respectively in group 2. These results were not significantly different (Mann-Whitney U test). Miners and labourers returned to work in 10 weeks (group 1) and 7.20 weeks (group 2). Patients who had undergone a lateral meniscectomy took longer to return to work—9.8 weeks in group 1 and 8 weeks in group 2.

The symptoms and results of examination in the two groups when seen as outpatients six months or more after operation were similar. In group 1 two patients had discomfort when playing football, one had a mild effusion six months postoperatively, and one had quadriceps wasting (1 inch; 2.5 cm). One of those in group 2 had discomfort when playing squash, one had a mild effusion eight months after operation, and one who had a degenerative lesion of the anterior horn lacked 30° flexion in the joint.

Comment

We suggest that applying an adequate splint and allowing early walking is more convenient and comfortable postoperatively for patients who have undergone routine meniscectomy. In addition, when beds are in short supply the quicker turnover reduces the waiting list, while time is also saved on physiotherapy. None of our patients who were treated in this way had complications, and a persistent effusion was not a problem. Return to work is not delayed, and the time before patients can resume full sporting activities may even be slightly reduced.

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Value of 1-alpha-hydroxy vitamin D₃ in treatment of primary hyperparathyroidism before parathyroidectomy

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Summary and conclusions

The postoperative course of six patients with primary hyperparathyroidism and obvious radiological evidence of bone disease pretreated with 1-alpha-hydroxy vitamin D₃ (1αHCC) was indistinguishable from that of six patients with a similar clinical and radiological picture who were not pretreated. 1αHCC may increase the hypercalcaemia in some cases and cannot be recommended for the routine preparation of such patients for surgery.

Introduction

Most patients with primary hyperparathyroidism seen in present-day practice do not have overt radiological evidence of

the disease when examined by standard techniques. After successful parathyroidectomy such patients rarely develop severe symptomatic hypocalcaemia. Patients with obvious radiological changes of hyperparathyroidism, however, may develop severe postoperative hypocalcaemia.¹ This may be difficult to control, especially as conventional vitamin D may not raise the serum calcium concentration for several days after the introduction of high-dose treatment. Because of the severity of the hypocalcaemic symptoms in some patients any treatment that would safely prevent hypocalcaemia would be an important advance. Pretreatment with 1α-hydroxy vitamin D₃ (1αHCC) has been claimed almost to abolish the postoperative symptomatic hypocalcaemia of patients with bone disease.² As a result, 1αHCC pretreatment has been advised in both primary and tertiary hyperparathyroidism associated with bone disease.³⁻⁵ We report our experience of 1αHCC treatment in six patients with primary hyperparathyroidism and radiological evidence of bone disease and compare it with the results in six patients with similar radiological changes who were not pretreated. The postoperative course in 14 patients without bone disease is also presented.

Patients and methods

Group A comprised 14 patients with primary hyperparathyroidism who had been recently investigated by one of us (DAH). None had radiological evidence of hyperparathyroidism, and in each case a single parathyroid adenoma was removed which resulted in cure.

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Group B comprised six patients with primary hyperparathyroidism who had obvious radiological evidence of the disease. All showed pronounced subperiosteal erosions of the phalanges in hand radiographs. Bone cysts were present in four cases. All six patients were cured by the removal of a single parathyroid adenoma. Except in case 4, in which initial pretreatment with 1 α HCC began eight days before surgery with a dose of 1 μ g/day increasing four days before surgery to 2 μ g/day, all patients were started five or six days pre-operatively on a dose of 2 μ g/day. This continued up to and included the day of operation. Postoperatively 1 α HCC was withdrawn, being reinstituted only when the managing physician considered it to be necessary. All other aspects of postoperative management were left to the consultant in charge.

Group C comprised six patients similar to those in group B. One was seen after completion of the study in group B; the other five were investigated before 1 α HCC became available. All six patients had pronounced periosteal erosions, and most had bone cysts. Management was identical with that in group B, except that 1 α HCC was not used.

Results

The table gives the ages and relevant biochemical details of patients in the three groups. There was no significant difference between

groups B and C in age or any biochemical variable. As expected, the patients with bone disease had higher mean serum calcium concentrations than those without. There was also significantly greater serum alkaline phosphatase activity in group B than group A.

The figure plots the postoperative serum calcium concentrations in the three groups of patients. In all cases in group A in which they were measured the concentrations had fallen to normal or below normal by the first postoperative day. Many patients in group A developed transient hypocalcaemia but none developed symptoms of this apart from occasional fleeting paraesthesiae of the mouth or limbs. No patient had a postoperative serum calcium concentration below 1.8 mmol/l (7.2 mg/100 ml), and none required postoperative calcium supplements or vitamin D. All had left hospital by the seventh post-operative day despite mild hypocalcaemia in some cases, and at follow-up all had remained persistently normocalcaemic without treatment.

In group B pretreatment with 1 α HCC 2 μ g/day was associated with no significant change in serum calcium concentrations in three of the six patients, while in two there was a slight increase of 0.3-0.4 mmol/l (see figure). In one patient, however, the concentration rose from 3.4 to 4.88 mmol/l (13.6 to 19.5 mg/100 ml) over three days. Withdrawal of treatment for 24 hours accompanied by fluid replacement resulted in the concentration falling to 3.8 mmol/l (15.2 mg/100 ml), and 1 α HCC was reinstituted at a dose of 1 μ g/day. Once again there was a progressive rise in the serum calcium concentration over the

Age distribution and biochemical values in the three groups of patients

		Age (years)	Serum calcium (mmol/l)	Serum phosphate (mmol/l)	Serum alkaline phosphatase* (U/dl)	Blood urea (mmol/l)
Group A (n=14)	Mean $\pm$ 1 SD	49.8 $\pm$ 15.9	2.95 $\pm$ 0.15	0.83 $\pm$ 0.19	11.6 $\pm$ 5.9	4.74 $\pm$ 1.44
	Range	17-83	2.84-3.29	0.52-1.10	4-28	3-9
Group B (n=6)	Mean $\pm$ 1 SD	55.8 $\pm$ 14.05	3.94 $\pm$ 0.38	0.84 $\pm$ 0.23	50.8 $\pm$ 36.9	7.27 $\pm$ 3.6
	Range	31-72	3.03-4.00	0.55-1.14	10-105	3.3-13.8
Group C (n=6)	Mean $\pm$ 1 SD	50.0 $\pm$ 8.29	3.30 $\pm$ 0.42	0.74 $\pm$ 0.16	22.0 $\pm$ 17.3	5.83 $\pm$ 1.61
	Range	36-58	2.72-3.75	0.58-1.0	6-45	3.8-8.0
A v B		NS	P < 0.01	NS	P < 0.01	NS
A v C		NS	P < 0.02	NS	NS	NS
B v C		NS	NS	NS	NS	NS

*Normal range 3-13 U/dl. Three patients had enzyme activity measured in international units. For approximate conversion to King-Armstrong units divide by 7.1. Conversion: SI to traditional units—Serum calcium: 1 mmol/l $\approx$ 4.0 mg/100 ml. Serum phosphate: 1 mmol/l $\approx$ 3.1 mg/100 ml. Blood urea: 1 mmol/l $\approx$ 6.0 mg/100 ml.

Changes in serum calcium concentrations after operation in three groups of patients. (A) Patients without bone disease. (B) Patients with bone disease pretreated with 1 α HCC (given on days -6 to 0). (C) Patients with bone disease not pretreated with 1 α HCC. Dashed lines indicate normal range. Operations performed on day 0.

Conversion: SI to traditional units—Serum calcium: 1 mmol/l $\approx$ 4.0 mg/100 ml.

next two days, so that by the day of operation the concentration was 4.38 mmol/l (17.5 mg/100 ml). In all six patients a single adenoma was removed at operation. After operation all patients showed a fall in serum calcium, but in four cases the values were still above normal the day after parathyroidectomy. Two patients continued to have concentrations above normal two days after operation, while in one patient the concentration did not reach the normal range until the fourth postoperative day. One patient (case 6) developed severe postoperative hypocalcaemia, which required prolonged intravenous calcium and oral vitamin D treatment. One other patient (case 5) developed persistent mild hypocalcaemic symptoms when the concentration fell to around 1.8 mmol/l (7.2 mg/100 ml). Treatment with 2 µg 1αHCC for several weeks rapidly corrected the hypocalcaemia. In all six patients the serum calcium concentrations remained normal on prolonged follow-up.

The six patients in group C had single adenomas removed at operation. The day after operation two still had a serum calcium concentration above normal, while in one a normal value was not achieved until the third postoperative day (see figure). In all patients the values had fallen below normal by the third postoperative day. In only one patient, however, did the concentration fall below 1.8 mmol/l. This patient (case 12) subsequently developed severe hypocalcaemic symptoms requiring intravenous calcium and vitamin D. Although several patients received occasional injections of intravenous calcium and oral calcium supplements, and one (case 8) received cholecalciferol 50 000 units for three days, it appears that in none except case 11 were the symptoms anything but transient and mild. All six patients ultimately achieved a normal serum calcium concentration without need for long-term calcium or vitamin D supplements.

Discussion

Patients with primary hyperparathyroidism without radiological evidence of bone disease usually have a straightforward postoperative course. All 14 patients in group A had left hospital within seven days of the operation. Mild, transient asymptomatic hypocalcaemia was common in this group but did not require specific treatment.

In group B severe postoperative hypocalcaemia had been anticipated. The simple, uneventful postoperative course in all patients except one was initially attributed to the preoperative use of 1αHCC, thus supporting the findings of Boyle *et al.*² Despite careful monitoring, one patient developed a severe worsening of the hypercalcaemia during pretreatment, with concentrations reaching dangerous values. After withdrawal of treatment for 24 hours the concentration fell towards pretreatment values, but reinstitution of 1αHCC at a lower dose (1 µg/day) was associated with a progressive rise in the concentration. Although impressed with the value of 1αHCC pretreatment we decided to compare the postoperative course in similar patients who were not treated with 1αHCC. Consequently the next patient encountered was not pretreated and had an uneventful postoperative course. Review of our previous cases of primary hyperparathyroidism disclosed five further patients with radiological evidence of bone disease who appeared to be clinically identical with the patients in group B. These six patients constituted group C. In only one did severe symptomatic hypocalcaemia develop that necessitated energetic treatment with calcium and vitamin D.

We were thus unable to detect any difference in postoperative course between the two groups with bone disease, though in both groups the course was more complicated than in the patients without bone disease. Although there was no significant difference in biochemical indices between the two groups with bone disease, the mean serum alkaline phosphatase value was lower in group C, perhaps indicating a less degree of bone disease in this group. Serum alkaline phosphatase activity,

however, is a poor guide to the magnitude of bone disease, and in fact the severest degree of hypocalcaemia recorded in group B was in the patient with the second lowest serum alkaline phosphatase value. A more likely explanation of our results is that patients with primary hyperparathyroidism and bone disease seen in present-day practice do not usually develop severe hypocalcaemia postoperatively. Such complications are more commonly seen in patients with chronic renal failure and osteodystrophy. Interestingly, Boyle *et al.*² used a case of hyperparathyroidism complicating chronic renal failure to illustrate the difficult postoperative course in their paper on the use of 1αHCC in primary hyperparathyroidism.

Several workers have pointed out that more-severe postoperative hypocalcaemia is seen in patients with radiological evidence of bone disease.¹⁻⁵ The earlier reported series of patients had a much higher incidence of bone disease which appears to have been more often of a much more severe nature than the changes seen in our patients. Even in these more severely affected patients pronounced hypocalcaemia appears to have been unusual. Pyrah *et al.*⁶ in a series of 68 patients, of whom 37 had skeletal changes, stated that "prolonged hypocalcaemia is exceptional." Fully developed tetany occurred in only three cases and was readily controlled. In a series reported on by Hellstrom and Ivermark,⁷ 59 (43%) out of 138 patients had skeletal changes, being generalised osteitis in 15 cases (25%). A postoperative serum calcium concentration below 1.75 mmol/l (7.0 mg/100 ml) was seen in 2 (2.5%) of the patients without bone disease and 11 (19%) of those with skeletal changes; in patients with generalised osteitis the incidence was 20%. A postoperative serum calcium concentration below 1.5 mmol/l (6.0 mg/100 ml) was seen in 2 (13%) of the patients with generalised osteitis. These are the patients likely to have developed severe tetanic symptoms, thus giving a closely similar incidence to that in the series reported by Pyrah *et al.*⁶ It therefore appears that severe postoperative hypocalcaemia is not a common problem in most patients seen in present-day practice with primary hyperparathyroidism and radiological evidence of bone disease. In fact, it may never have been a common problem even in the earlier series reported. Hence the good results obtained by Boyle *et al.*² may have been completely unrelated to the use of 1αHCC.

From our results we recommend that 1αHCC should not be used preoperatively to prepare patients for operation, giving no obvious advantage but adding the danger of worsening hypercalcaemia. Its rapid action and short half life,⁸ however, make it suitable for use in the postoperative period should severe hypocalcaemia develop. Whether 1αHCC pretreatment is beneficial in preparing patients with renal osteodystrophy before parathyroidectomy remains to be proved.

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