ABSTRACT—Physician members of the Thoracic Society and the Bone and Tooth Society were circularised about their views on the prophylaxis, screening and treatment for steroid osteoporosis. Bone physicians were more active than respiratory physicians in screening and prophylaxis and were more likely to favour bone densitometry in assessment and bisphosphonates in treatment. Further studies are required to establish the value of prophylactic agents in steroid osteoporosis but meanwhile respiratory physicians should appreciate the value of the relatively simple technique of bone densitometry in assessment and consider whether they should be more active in prophylaxis.

Corticosteroids are useful in the management of a number of chronic diseases, including asthma, rheumatoid arthritis, and inflammatory bowel disease. One of the major complications of such treatment is osteoporosis, and 15–20% of patients with vertebral crush fractures or hip fractures have a history of steroid therapy [1,2]. There is no consensus, however, on the prevention, identification and treatment of steroid-induced osteoporosis. We have therefore used a self-administered questionnaire to compare the practice of respiratory and bone physicians in this respect.

Methods

Subjects

A questionnaire was sent to all physician members of the British Thoracic Society and physician members of the Bone and Tooth Society who are known to be interested in bone metabolism. One reminder was sent to those who failed to respond to the first questionnaire.

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Questionnaire

Participants were asked about the management of steroid-induced osteoporosis in men and in pre-menopausal and postmenopausal women. Questions were asked about policy on performing baseline investigations before steroid therapy, monitoring for adverse effects while on steroids, and the value of prophylactic treatment to prevent bone loss. Details were requested about investigation and treatment during screening and prophylaxis from those so committed, and all respondents were asked about the management of established osteoporosis. Those who suggested screening were asked if there was a dose of prednisolone below which osteoporosis was unlikely to occur, and those who undertook prophylaxis were asked when it should be started. Information was also obtained about the age and place of work (teaching hospital or district general hospital) of all respondents.

Copies of the questionnaire are available from the authors.

Statistical methods

Standard methods for the analysis of contingency tables (Chi-square, Fisher's Exact Test) were used to test for the statistical significance of differences between bone and respiratory physicians. These methods were also used to investigate association between the age of the physicians, or their place of work (teaching or district general hospital), and responses to the questionnaire.

Results

Replies were received from 236 of 378 (62.4%) respiratory physicians and from all 13 bone physicians; 57% of the respiratory physicians were below the age of 45, and 29% between 45 and 55, while five of the bone physicians were aged less than 45 and six more between 45 and 55. More respiratory physicians (64%) worked in district general hospitals, but all 13 bone physicians were based in teaching hospitals.

Bone physicians favoured monitoring for osteoporosis, offering prophylactic treatment to prevent bone loss during therapy, and performing baseline investigations before steroid therapy (Table 1). Most bone physicians, but few respiratory physicians, used bone densitometry, and more bone physicians used urine
Steroid-induced bone disease

Table 1. Number (percentage) of respiratory and bone physicians recommending baseline measurements, screening and prophylaxis for bone disease in patients taking oral steroids.

| Subjects                  | Physicians | n   | Baseline screening | Prophylaxis* |
|---------------------------|------------|-----|--------------------|--------------|
|                           |            |     | Before treatment   | During treatment |     |
| Men                       | Respiratory| 236 | 3 (1%)             | 6 (3%)        | 21 (9%)      |
|                           | Bone       | 13  | 6 (46%)            | 8 (62%)    | 5 (45%)       |
| Women, premenopausal      | Respiratory| 236 | 3 (1%)             | 6 (3%)        | 22 (9%)      |
|                           | Bone       | 13  | 6 (46%)            | 8 (62%)    | 5 (45%)      |
| Women, postmenopausal     | Respiratory| 236 | 10 (4%)            | 15 (6%)    | 42 (18%)     |
|                           | Bone       | 13  | 7 (54%)            | 9 (69%)    | 7 (64%)       |

All comparisons between respiratory and bone physicians give \( p<0.001 \).

*Two bone physicians reported seeing too few patients to comment on prophylaxis, and the reported percentages are based on the 11 remaining bone physicians.

hydroxyproline measurements to assess bone resorption (Table 2); bone physicians requested more isotope bone scans and recommended X-ray of the dorsal lumbar spine. The latter procedure was used widely by both groups. The use of other investigations was broadly similar in the two groups.

Bone physicians favoured bisphosphonates and oestrogens to prevent and treat steroid-induced osteoporosis, while none recommended hydroxyapatite which was used by 17\% of respiratory physicians in the management of established disease (Table 3). Only four (\(<2\%)\) respiratory physicians prescribed androgens for men with established disease, as opposed to five out of 12 bone physicians.

Of the nine bone physicians who screen, one suggested that osteoporosis was unlikely at doses of 10 mg prednisolone or less per day, while five gave a limit of 5 mg. Three did not think there was a safe dose. Among the 15 respiratory physicians who screen, two suggested a threshold of 10 mg or less, three said 7.5 mg, two said 5 mg, one said 2.5 mg, while seven gave no safe dose. More bone physicians regarded the start of prophylaxis as urgent, seven out of the eight respondents opting to start immediately. Although 53\% of the 34 respiratory physicians responding to the question would indeed institute prophylaxis at the start of therapy, 21\% wait more than six months.

The ages of the respiratory physicians and place of work (teaching hospital or district general hospital) were found to have no statistically significant association with responses to any part of the questionnaire.

Discussion

There was a good response to the questionnaire, as replies were received from the majority of respiratory physicians and all bone physicians contacted. We therefore feel that the views expressed were representative of each specialty, though there was considerable diversity within each group. There were clear differences in the practice of respiratory and bone physicians in preventing, identifying and treating osteoporosis in patients on steroid therapy. In contrast to the bone physicians, few respiratory physicians per-

Table 2. Number (percentage) of respiratory and bone physicians recommending specific investigations for screening during steroid therapy and before treatment of established bone disease in postmenopausal women

| Investigation                  | Screening | Treatment |
|--------------------------------|-----------|-----------|
|                                | Respiratory| Bone      | Respiratory| Bone         |
| n                              | 15        | 9         | 236        | 13           |
| X-ray dorso-lumbar spine       | 13 (87\%) | 8 (89\%)  | 174 (74\%) | 13 (100\%) a|
| Skeletal survey                 | 0 (0\%)   | 0 (0\%)   | 42 (18\%)  | 1 (8\%)      |
| Isotope bone scan              | 1 (7\%)   | 0 (0\%)   | 20 (8\%)   | 4 (31\%) a   |
| Fasting serum calcium          | 7 (47\%)  | 3 (33\%)  | 97 (41\%)  | 6 (46\%)     |
| 24-hour urine calcium          | 2 (13\%)  | 0 (0\%)   | 37 (16\%)  | 4 (31\%)     |
| Urine hydroxyproline           | 0 (0\%)   | 2 (22\%)  | 13 (6\%)   | 7 (54\%) b   |
| Bone densitometry              | 1 (7\%)   | 9 (100\%) | 9 (4\%)    | 12 (92\%) b  |

\[ p<0.05 \quad \text{b} p<0.001.\]
formed baseline investigations before starting steroid therapy, monitored for adverse effects of steroids on bone, or used prophylactic treatment to prevent bone loss. Although the majority of respiratory and bone physicians performed spine X-rays in the investigation of probable and established steroid osteoporosis, bone densitometry was used extensively by the bone physicians but only rarely by the respiratory physicians. This may reflect the lack of access of respiratory physicians to bone densitometry facilities, though it may also be due to ignorance of the value of these techniques. As fracture risk is closely related to bone mineral density [3], which can now be measured easily and accurately in the forearm, lumbar spine, and femoral neck [4], these techniques could be useful in the early identification of steroid-induced osteoporosis.

Among the 69% of bone physicians and 18% of respiratory physicians who advocated prophylactic treatment to prevent bone loss in patients on steroids, the use of calcium supplements was similar, but bisphosphonate and oestrogen treatment was used more often by the bone physicians. The majority of bone physicians and respiratory physicians also used calcium supplements to treat established steroid osteoporosis, but again bisphosphonate and oestrogen treatment was used more widely by the bone physicians.

Although there are few studies on the role of bisphosphonates and oestrogen in the prevention and treatment of steroid-induced osteoporosis, these compounds have been shown to prevent cortical and trabecular bone loss in postmenopausal osteoporosis and to reduce the incidence of further fractures [5,6]. It is likely that these antiresorptive agents will also be effective in the management of steroid-induced osteoporosis, where bone resorption is also increased, though further studies are clearly required to determine if this is the case [7]. Meanwhile, physicians instituting long-term steroid therapy should be aware of bone densitometry techniques which will detect early osteoporosis, and of therapeutic interventions which may prevent further bone loss.

### References

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Table 3. Number (percentage) of respiratory and bone physicians recommending specific therapy for prophylaxis and treatment of postmenopausal women

| Therapy          | Prophylaxis | Treatment |
|------------------|-------------|-----------|
|                  | Respiratory | Bone      | Respiratory | Bone    |
| Calcium          | 42          | 9         | 236         | 12*      |
| Bisphosphonate   | 30 (71%)    | 5b (56%)  | 142 (60%)   | 9 (75%)  |
| Hydroxyapatite   | 1 (2%)      | 5 (56%)c  | 13 (6%)     | 0 (0%)   |
| Thiazide diuretic| 11 (26%)    | 0 (0%)    | 41 (17%)    | 0 (0%)   |
| Fluoride         | 2 (5%)      | 0 (0%)    | 9 (4%)      | 0 (0%)   |
| Vitamin D        | 9 (21%)     | 1 (11%)   | 3 (1%)      | 1 (8%)   |
| Oestrogens       | 21 (50%)    | 9 (100%)d | 61 (26%)    | 3 (25%)  |
| Androgens        | 0 (0%)      | 1 (11%)   | 88 (37%)    | 8 (67%)  |
| Anabolic steroids| 2 (5%)      | 0 (0%)    | 17 (7%)     | 3 (17%)  |
| Calcitonin       | 0 (0%)      | 1 (11%)   | 9 (4%)      | 2 (17%)  |

*One respondent entered all patients into clinical trials.

bTwo other respondents reported using calcium only with bisphosphonate.

cp<0.001 dp<0.01.