Combined radioguided parathyroidectomy and intravenous vitamin D therapy for the treatment of uraemic hyperparathyroidism

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Abstract
Therapy combining radioguided parathyroidectomy (PTx) followed by intravenous maxacalcitol was given to a 50-year-old Japanese man referred for treatment of uraemic secondary hyperparathyroidism. After laboratory and radiological examinations, the patient underwent uncomplicated, successful surgery, but glands that had not been detected radiologically before the procedure became apparent with a scintillation counter immediately after the removal of the swollen gland. To prevent relapse of secondary hyperparathyroidism in the remaining glands, 10 mg of maxacalcitol was injected intravenously after each dialysis session. Following a minimally invasive radioisotope-guided PTx, the potential risk of relapse in the remaining glands has to be considered and intensive medical therapy should be instituted immediately after the operation. Further study needs to elucidate whether this treatment strategy can improve the long-term prognosis of patients with secondary hyperparathyroidism.

Keywords: maxacalcitol; radioisotope-guided parathyroidectomy; secondary hyperparathyroidism

Introduction
Minimally invasive radioisotope-guided parathyroidectomy (PTx) is a promising intervention for patients with secondary hyperparathyroidism [1–3]; however, if radiologically inactive parathyroid glands remain after the operation, the potential risk of recurrence in those glands has to be considered [4].

Case report
A 50-year-old Japanese man was referred for treatment of uraemic secondary hyperparathyroidism. He had been on maintenance haemodialysis therapy for 19 years because of advanced chronic glomerulonephritis. Secondary hyperparathyroidism with bilateral foot pain became evident when he was 45 years old, and since that time he had been receiving active vitamin D therapy, including oral pulse therapy, that had not been effective. The foot pain gradually became intolerable.

A swollen parathyroid gland, 18 x 14 x 10 mm in size, was detected near the right lobe of the thyroid gland, but no other glands were found by ultrasonographic examination. Results of laboratory tests confirmed azotaemia, hyperparathyroidism, hypercalcaemia and hyperphosphataemia (Table 1). 1-HmTc-MIBI scintigraphy revealed a radiologically hyperactive parathyroid gland near the lower edge of the right thyroid lobe (Figure 1), and it was resected using a radioisotope-guided procedure.

The operation was uncomplicated and successful, but, after the removal of the swollen gland, other glands that had not been detected were found with a scintillation counter during the operation.

After the operation, the concentration of plasma intact PTH decreased from 906 to 44 pg/ml, accompanied by a decrease in serum calcium and inorganic phosphate concentrations. The concentration of alkaline phosphatase transiently increased, as generally occurs after successful parathyroidectomy. After the operation, 10 mg of maxacalcitol was injected intravenously following every dialysis session for 4 weeks and then the therapy was changed to oral...
alfacalcidol administration. The dosage of alfacalcidol was increased when the concentration of plasma intact PTH increased to 303 pg/ml. Meanwhile, the patient’s foot pain disappeared (Figure 2).

Discussion

Nodular parathyroid hyperplasia consisting of a proliferated monoclonal clone [5] is found commonly in cases of secondary hyperparathyroidism refractory to medical therapy [6]. In uraemic patients, medical therapy must be instituted before the appearance of an abnormal clone.

![Table 1. Laboratory analyses of the present case](image)

<table>
<thead>
<tr>
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<tr>
<td>WBC</td>
<td>5360/mm³</td>
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<tr>
<td>RBC</td>
<td>392 x 10⁶/mm³</td>
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<tr>
<td>Hb</td>
<td>13.6 g/dl</td>
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<tr>
<td>Pt</td>
<td>17.5 x 10⁹/mm³</td>
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<td>pH</td>
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<tr>
<td>CO₂</td>
<td>41.1 mmHg</td>
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<tr>
<td>Po₂</td>
<td>93.1 mmHg</td>
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<tr>
<td>HCO₃</td>
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<td>BE</td>
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<tr>
<td>SaO₂</td>
<td>93.1%</td>
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<tr>
<td>Ca²⁺</td>
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<tr>
<td>Albumin</td>
<td>3.3 g/dl</td>
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<td>BUN</td>
<td>58 mg/dl</td>
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<tr>
<td>Cre</td>
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<tr>
<td>Ca³⁺</td>
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<td>K</td>
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<td>Cl</td>
<td>102 mEq/l</td>
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<tr>
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<td>12 IU/l</td>
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<tr>
<td>GPT</td>
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<tr>
<td>γ-GPT</td>
<td>53 IU/l</td>
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<tr>
<td>ALP</td>
<td>159 IU/l</td>
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<td>LDH</td>
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<tr>
<td>i-PTH</td>
<td>905 pg/ml</td>
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The parathyroid glands that had been radiologically undetectable were found by a scintillation counter immediately after the radioisotope-guided subtotal PTx, probably because of immediate activation of the remaining parathyroid glands after the cancellation of negative feedback from the abnormally hyperactivated parathyroid gland. This indicated the need for medical therapy, and intravenous vitamin D was given immediately after the operation.

This therapy is relatively safe because hypercalcaemia, the only notable side effect, is offset by the tendency towards hypocalcaemia that generally follows PTx. Nevertheless, the hypercalcaemic tendency associated with long-term maxacalcitol injection therapy must be monitored. It has not been confirmed
in haemodialysis patients whether maxacalcitol aggravates the hypercalcaemic tendency as much as calcitriol [7].

This strategy appears to be similar to intravenous vitamin D therapy following percutaneous ethanol injection into the parathyroid gland(s) [8]. However, the main target of the treatment is the surviving monoclonal clones in the ethanol-injected parathyroid gland, because not all the cells in the gland are killed by direct ethanol injection. In contrast, all the cells in a targeted parathyroid gland are removed by radioisotope-guided PTx. Therefore, the target of the maxacalcitol injection in the present strategy is not the surviving clones, but the remaining parathyroid glands, and the goal is prevention of hyperparathyroidism occurring in those parathyroid glands.

**Conclusion**

The present report describes a combined therapy of radioisotope-guided PTx and intravenous maxacalcitol for the treatment of uraemic hyperparathyroidism. Intensive medical therapy should be applied immediately after the operation. Further study of this treatment strategy is important to elucidate whether it can improve the long-term prognosis of patients with secondary hyperparathyroidism.

**References**