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## ORIGINAL ARTICLE

# Applying preoperative dipyridamole thallium-201 scintigraphy for preventing cardiac mortality and complications for patients with secondary hyperparathyroidism undergoing parathyroidectomy

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**KEYWORDS**Secondary hyperparathyroidism;  
Dialysis;  
Coronary artery disease (CAD);  
Dipyridamole thallium-201 scintigraphy

**Summary** *Background:* To evaluate the value of preoperative dipyridamole thallium-201 scintigraphy for reducing cardiovascular complication in secondary hyperparathyroidism (SHPTH) patients.

*Methods:* Thallium scintigraphy was arranged for all dialysis patients who underwent parathyroidectomy from Jan 2011 to July 2015. Management of defects on thallium scintigraphy included cardiac catheterization and ultrasonography. Analysis includes 30-day mortality, morbidity and the predicting factors for thallium scintigraphy defect.

*Results:* Of 249 patients with SHPTH, 19 (7.6%) had defects on thallium scintigraphy, 15 (88%) of whom had coronary artery disease on angiography. History of acute coronary syndrome (ACS,  $p < 0.001$ ), diabetes mellitus (DM,  $p = 0.03$ ), male sex ( $p = 0.03$ ), and higher body mass index (BMI,  $p = 0.001$ ) were significant predictors of positive thallium scintigraphy results. History of ACS was the most significant predictor after adjustment in the multivariate logistic analysis (odds ratio, 22.56; 95% confidence interval, 7.02–72.53). All the patients survived the 30-day postoperative period, with minimal cardiovascular morbidity.

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E-mail address: [choulu@ms4.hinet.net](mailto:choulu@ms4.hinet.net) (F.-F. Chou).<http://dx.doi.org/10.1016/j.asjsur.2017.03.004>1015-9584/© 2017 Asian Surgical Association and Taiwan Robotic Surgical Association. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

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**Conclusion:** Preoperative dipyridamole thallium-201 scintigraphy is useful for SHPTH patients to minimized surgical mortality and morbidity.

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## 1. Introduction

Patients with end-stage-renal-disease (ESRD) who are dialysis-dependent often present with a higher perioperative mortality compared with the general population. In a systemic review by Mathew et al,<sup>1</sup> the pooled incidence of postoperative death was 5.1 fold higher in dialysis patients who underwent noncardiac surgery. Other published series have shown perioperative mortality rate ranging from 10% to 70% depending on surgical type and emergency level.<sup>2–4</sup> Secondary hyperparathyroidism (SHPTH), which present as a major complication among patients undergoing dialysis, is characterized by several independent risk factors for all-cause and cardiovascular mortality, including high circulating levels of serum parathyroid hormone (PTH), hypercalcemia and hyperphosphatemia.<sup>5</sup> Several series have also demonstrated that abnormal mineral metabolism significantly increases risks of morbidity and mortality risk in patient undergoing dialysis.<sup>6–9</sup> Additionally, dialysis patients with severe SHPTH may develop bone pain, pruritus, cardiovascular disease and fractures, thus contributing to poor health-related quality of life.<sup>10</sup>

Parathyroidectomy (PTx) can result in a substantial decrease in PTH levels and corrected serum calcium and phosphate levels, thus contributing to the patients' relief from clinical symptoms. According to Kidney Disease: Improving Global Outcomes (KDIGO) guidelines, PTx was recommended for patients with chronic kidney disease stages 3–5 and severe secondary hyperparathyroidism refractory to medical therapy.<sup>11</sup> The Kidney Disease Outcomes Quality Initiative (K/DOQI) clinical practice guidelines also recommend PTx when pharmacotherapy and other minimally invasive treatment options are ineffective.<sup>12</sup> Komaba et al have also suggested that successful PTx may reduce the risk for all-cause and cardiovascular mortality in hemodialysis patients with severe, uncontrolled SHPTH.<sup>13</sup>

Although PTx is usually regarded as a safe procedure, the 30-day postoperative mortality rate following PTx has been reported to vary from 0.9% to 3.1% in different studies.<sup>14,15</sup> The dominant cause of death during the first month and first year after PTx was cardiovascular disease, followed by endocrinal, tumor-related, and respiratory complications.<sup>16</sup> Therefore, efforts to lower the risk and complications from cardiovascular disease before PTx have become critical.

Dipyridamole thallium-201 myocardial imaging is a common noninvasive test for the diagnosis of coronary arterial disease (CAD). Despite the widespread use of the scans, the independent predictive and prognostic value of thallium-201 scintigraphy for preoperative evaluation remains controversial. The purpose of this study was to

evaluate the value of preoperative dipyridamole thallium-201 scintigraphy as a screening method to minimize perioperative cardiac complication in patients with SHPTH undergoing PTx. In addition, we identified the high risk and predictive power in patients with SHPTH who had abnormal findings in the thallium-201 myocardial perfusion scan.

## 2. Materials and methods

### 2.1. Patient population and data collection

Dialysis patients who underwent PTx from Jan 2011 to July 2015, at Kaohsiung Chang Gung Memorial Hospital were selected from our KCGMH electronic medical database. After approval by The Institutional Review Board of the Chang Gung Memorial Hospital, all patients' historical charts were reviewed by two independent research nurses. For inclusion in the study, patients must have undergone either peritoneal dialysis or hemodialysis for more than 6 months. Patients who underwent renal transplantation, whose laboratory data were incomplete, and who were lost to postoperative follow up at our outpatient department were excluded. Severe SHPTH was identified in patients with (1) intact parathyroid hormone (iPTH) values greater than 800 pg/dL, regardless of receiving vitamin D therapy (2) iPTH value greater than 800 pg/dL with intolerable clinical symptoms (bone and joint pain, muscle weakness, irritability, itching, etc.) refractory to medical treatment and referred from the Department of Nephrology.

### 2.2. Preoperative evaluation and management

All surgical patients underwent dipyridamole thallium-201 scintigraphy before PTx. Patients with abnormal thallium scan results were referred for cardiology consultation. The decision to perform further evaluations and interventions was at the discretion of the surgeons and cardiologists, who were experts in coronary catheterization. Indications for coronary angiography were based on clinical findings: new or medically unstable angina, previous or recent myocardial infarction (MI), or persistent angina. Stent implantation or plain old balloon angioplasty (POBA) during angiography was performed depending on the severity of angiography finding and clinical symptoms, and mostly among patients with coronary arterial stenosis >50%, 3-vessel disease or left main artery occlusion. Patients with abnormal thallium scan results who refused coronary angiography underwent further cardiac ultrasonography evaluation, ensuring adequate left ventricular ejection fraction and the exclusion of other abnormalities such as moderate-to-severe valvular stenosis and regurgitation, vegetation and

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