

Intraoperative localization of parathyroid adenoma utilizing intravenous methylene blue

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Keywords: Parathyroid; hypercalcaemia; sestamibi

Introduction

Primary hyperparathyroidism is a disease of parathyroid glands, which manifest as hypercalcaemia due to excess production of parathyroid hormone (PTH). It is the most common cause of hypercalcaemia in the ambulatory setting. In nearly 80% of cases, solitary parathyroid adenoma accounts for primary hyperparathyroidism, which is surgically curable [1]. Accurate preoperative localization of the affected gland results in shorter operative time and to identify ectopic parathyroid adenoma [4].

This report presents a case of primary hyperparathyroidism due to a solitary parathyroid adenoma.

Case presentation

A 72 year old Sri Lankan woman from the Northern province presented with polydipsia, polyuria, fatigue and weakness. She also reported a long standing epigastric burning pain. Five years ago, she underwent left sided pyelolithotomy for a renal pelvic calculus. She has hypertension and dyslipidaemia.

Examination revealed no abnormal physical findings. Serological tests demonstrated hypercalcaemia; serum ionized calcium level was 3.11 mmol/L and an elevated parathyroid hormone (PTH 189.7 ng/L). Ultrasounds scan (USS) neck revealed a right parathyroid adenoma. A computed tomography (CT) of the neck confirmed the parathyroid adenoma of 7mm in size. Technetium-99m (Tc-99m) sestamibi scintigraphy failed to identify abnormal focal retention of tracer in the parathyroid region of the neck or elsewhere in ectopic locations and concluded as no evidence of demonstrable parathyroid adenoma. Therefore intravenous methylene blue was used to localize the parathyroid gland intraoperatively. A collar incision was made for bilateral neck

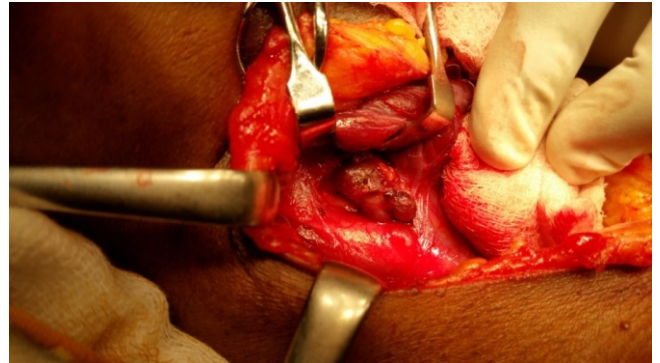


Figure 1: Right parathyroid adenoma during surgery

exploration. Right superior parathyroid gland was identified as enlarged with methylene blue staining. Excision of the right parathyroid adenoma was done (Figure 1). Other parathyroid glands were normal in size and were free of methylene blue stain. Postoperative recovery was uneventful except post operative hypocalcaemia. Serum calcium reduced to 1.97 mmol/L in the forth post operative day and returned to normal value in a week's time. Histology confirmed the parathyroid adenoma which composed of solid sheets of chief cells.

Discussion and conclusion


An increasing proportion of patients with primary hyperparathyroidism are now being diagnosed at the stage of mild symptomatic disease or asymptomatic stage by incidental finding of hypercalcaemia. Untreated hyperparathyroidism leads to recurrent renal stones, osteitis fibrosa cystica, pancreatitis, gastritis, polyuria, polydipsia, constipation or cognitive impairment [4]. Of those clinical presentations, nephrolithiasis is the most common [1]. Hyperparathyroid crisis is a rare condition, where patients present with lethargy, weakness, vomiting, abdominal pain and confusion. It is an endocrine emergency which requires rapid correction of dehydration and hypercalcaemia followed by surgical resection of diseased parathyroid glands [2].

Preoperative imaging techniques are necessary for localization of the diseased glands. USS neck, CT, MRI and Tc-99m sestamibi scintigraphy are useful imaging techniques [1, 3]. Studies have shown that there are no significant differences in sensitivity and positive predictive value in

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Received: 13-06-2017 Accepted: 15-10-2017

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DOI: <http://doi.org/10.4038/sljs.v35i3.8414>



identifying pathologic parathyroid gland between USS neck and sestamibi scintigraphy. However, the combination increases the sensitivity and positive predictive value compared to either single technique [4]. In our patient, initial USS neck and CT scan localized the parathyroid gland although Tc-99m sestamibi scintigraphy failed to localize the parathyroid adenoma.

The only definitive treatment for primary hyperparathyroidism due to parathyroid adenoma is surgical resection of the gland/ glands. Bilateral neck exploration, direct visualization, identification and removal of all abnormal parathyroid glands is considered as the gold standard [1]. Methylene blue is efficacious in intra operative identification of enlarged parathyroid glands with only mild toxicity. Methylene blue is a thiazine dye which contain methylene blue trihydrate as an active ingredient. It stains parathyroid adenoma with a range of 86-100 %. Mechanism of selective uptake of methylene blue by the hyperactive parathyroid gland is poorly understood. Although the accumulation of methylene blue within the mitochondrial matrix was noted and predominance of oxyphil cells rich in mitochondria within the hyperactive parathyroid gland may explain the selective uptake of methylene blue [5].

Focus parathyroidectomy using unilateral neck exploration is facilitated by preoperative radiological localization of parathyroid adenoma and intra operative PTH measurement. PTH has a half life of less than 5 minutes and can be measured before and after adenoma excision to ensure that the suspected adenoma has been removed. Intra operative gamma probe identification also assists with intra operative parathyroid adenoma localization [1]. Preoperative differentiation between benign and malignant parathyroid lesion is often challenging task. Studies suggest that preoperative PTH value can be helpful as a PTH level less than four times the upper limit of normal excludes a malignancy. However, benign conditions presenting with very high level of PTH is also

reported in the literature [2]. Therefore intra operative assessment of the enlarged parathyroid gland is necessary to differentiate benign from malignant enlargement as malignant lesion will need a more radical procedures. Adherence due to fibrosis, local infiltration or lymph node involvement favors malignant lesion [1]. Decrease in serum calcium level is usually mild following successful removal of hyperactive parathyroid glands. Post operative hypocalcaemia ensures that hyperactive gland has been successfully removed [3].

In summary, primary hyperparathyroidism can present with nonspecific symptoms, high index of suspicion is necessary for diagnosis. It can be surgically curable if the exact location of diseased glands could be identified and excised. Intraoperative methylene blue is a valuable localization tool.

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Learning Points

- Hypercalcaemia must be considered in patients complaining of recurrent abdominal pain or nonspecific symptoms
- Localization of parathyroid adenoma is facilitated by ultrasound scan and CT scan pre operatively .
- Intraoperative methylene blue is a safe and effective way of locating the adenoma.