

# Awake Parathyroidectomy in a Patient with Aortic Stenosis with Renal Failure: Role of Regional Plexus Block, A Viable Alternative to General Anaesthesia

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## Abstract

**Introduction:** Primary hyperparathyroidism is a hypercalcemic state due to excessive secretion of parathyroid hormone (PTH). The most common cause being single parathyroid adenoma. Majority of these cases detected by screening of serum calcium concentration, are older individuals who present with associated comorbidities. Few patients may present with Hyperparathyroid crisis a serious and potentially life threatening complication of severe primary Hyperparathyroidism. Parathyroidectomy leads to the cure of the disease. Parathyroidectomy for localized adenomas are usually performed under general anaesthesia, however cervical plexus block is also a good alternative. **Case Report:** We describe the anaesthetic management of a 72 years old, ASA III MP III male patient who underwent parathyroid adenoma (right) excision under combined superficial and deep cervical plexus block. Patient was a diagnosed case of primary hyperparathyroidism. Other comorbidities being moderate aortic stenosis, ischaemic heart disease, chronic kidney disease, hypertension and cervical spondylosis. Patient was having regular episodes of parathyroid crisis and had to be operated upon, but the patients' medical

condition contradicted general anaesthesia so patient was operated under right sided combined superficial and deep cervical plexus block with awake sedation, resulting in excellent anaesthesia of the operation site, stable haemodynamics, adequate intraoperative analgesia with reduced postoperative analgesic requirement. **Discussion:** Cervical plexus blocks the motor and sensory nerves originating from C2 to C4 nerve roots. It has been shown to be safe for thyroid and parathyroid surgeries, with cure rates equivalent to general anaesthesia. Parathyroidectomies done under regional anaesthesia significantly reduced post-operative pain, nausea, and vomiting. However the studies available till now on regional versus general anaesthetic approach for parathyroidectomies do not yield definitive information, regarding which technique is superior. Hypercalcemia along with associated muscular weakness was another reason why cervical plexus block was preferred in our patient. **Conclusion:** Thus cervical plexus block may be used as an alternative to general anaesthesia for thyroid and parathyroid surgeries, especially in patients with multiple co morbidities in whom administering a general anaesthesia may be problematic.

**Keywords:** Hyperparathyroidism; Aortic Stenosis; Hyperparathyroid Crisis; Cervical Plexus Block.

## Introduction

Primary Hyperparathyroidism (PHPT) is a hypercalcemic state due to excessive secretion of Parathyroid Hormone (PTH) [1]. Causes being single parathyroid adenoma (most common) in 90% of the cases, multiple adenomas or hyperplasia and rarely carcinoma 1-2% of the cases [2]. Primary hyperparathyroidism due to parathyroid hyperplasia is less common and may occur in the context of the syndrome of Multiple Endocrine Neoplasia (MEN) [3]. Parathyroid crisis is a rare manifestation of Primary Hyperparathyroidism for which Parathyroidectomy is the only curative therapy [4]. Usually parathyroidectomies are performed under General

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Anaesthesia (GA) using a supraglottic airway devices or routine endotracheal tube. The presence of comorbid conditions like symptomatic heart disease, airway and cervical spine abnormalities, renal derangement etc. makes the administration of general anaesthesia risky in these patients. Regional anaesthetic techniques with or without conscious sedation has also been shown to be safe in these patients and allows for cure rates equivalent to GA [5]. Regional anesthetic block of the cervical plexus is a safe and useful alternative to general endotracheal anesthesia for surgery of the neck, upper shoulder and occipital scalp area. The sensory component of the cervical plexus can be blocked separately and easily by a superficial cervical plexus block. Both motor and sensory block can be obtained by deep cervical plexus block. Minor transient side effects are common to deep cervical plexus blocks, but they are rarely of any consequence [6].

### Case Report

A 72 year old American Society of Anaesthesiology (ASA) physical status III male patient weighing 65 kgs was posted for parathyroidectomy. Patient was a diagnosed case of parathyroid adenoma with primary hyperparathyroidism. He has had two episodes of Hyperparathyroid Crisis within last 30 days needing hospitalisation. His other comorbidities being vulvular heart disease (moderate aortic stenosis) NYHA Class III at present diagnosed at the age of 60 years, cervical spondylosis for last 20 yrs, hypertension for last 15 yrs, ischaemic heart disease for last 5 years and recently diagnosed chronic kidney disease. He was on the following medications Tab. Metoprolol 25 mg, Tab. Furosemide 40mg, Tab. Aspirin 75 mg. On Preanesthetic Check-up, Pulse Rate (PR) was 86/min, Blood Pressure (BP) 150/80 mmHg, Respiratory Rate (RR) was 20/min and MET (Metabolic Equivalent of Physical Activity) 4. He had a Mallampati grade of III with moderately restricted neck movement, edentulous tooth, a large tongue and absent buccal pad of fat. Systemic examination revealed an ejection systolic murmur, heard loudest at the upper right sternal border & at the right 2nd intercostal space which radiated to the carotid arteries bilaterally. All routine investigations were within normal limit except pre-operative Haemoglobin being 8.4 gm% after one unit whole blood transfusion, Urea 70 mg/dl, Creatinine 2.85 mg/dl, Calcium ( $Ca^{++}$ ) 14.6 mg/dl, Phosphate 2.5 mg/dl, Parathyroid hormone (PTH) level 878 pg/ml, Alkaline Phosphatase was 830 IU/L, coagulation

profile normal. Chest X-Ray showed cardiomegaly. Electro Cardiogram had a left axis deviation with T wave inversion in  $V_{3-5}$  leads. Transthoracic Echocardiography showed moderate AS with thickened calcific aortic valve (AVA=1.4  $cm^2$ , mean gradient of 40 mm Hg), concentric LVH, Grade-I diastolic dysfunction and LVEF 50%. Ultrasound scan neck revealed a 2.5 cm well-defined mass inferoposterior to right thyroid lobe. Parathyroid scintigraphy confirmed hyperfunctional parathyroid tissue in the posteroinferior aspect of right thyroid gland with brown tumour involving right upper humerus. The patient, relatives and medical specialists decided to go ahead with surgery, in spite of the risks as he was having regular episodes of hyperparathyroid crisis. He was counselled on the previous day about the merits and demerits of both general and regional anesthesia techniques. Anaesthetic plan formulated was cervical plexus block. Cardiac risk evaluation was done. On arrival at the operation room, an intravenous line was secured with 18G cannula and isotonic saline was started. All anesthetic equipments were prechecked and standard ASA monitors were attached to the patient. Electrocardiogram (ECG), Oxygen Saturation (SpO<sub>2</sub>), Noninvasive Blood Pressure (NIBP), and Heart Rate (HR) were monitored continuously throughout the intraoperative period. Patient was premedicated with Inj. Midazolam 1mg IV, Inj. Fentanyl 50 mcg IV. Under strict aseptic and antiseptic precaution, landmark based right sided combined superficial and deep cervical plexus block was performed. A 22G needle connected via an extension 3 way to a 20ml syringe containing local anaesthetic, was used for superficial cervical plexus block (SCPB) and three injections of 5 mL of 0.5% ropivacaine were injected at the SCPB needle insertion site subcutaneously in perpendicular, cephalad and caudad directions in a 'fan' shaped fashion after negative aspiration for blood. For deep cervical plexus block (DCPB), a single-injection technique was followed. A 5 cm 22 gauge needle was inserted at the second needle entry site, at 2cm depth when the transverse process of C3 vertebra was approached, the needle was withdrawn slightly and 15 ml of 0.5% ropivacaine was injected after negative aspiration for blood and CSF.

Supplemental oxygen was delivered @4 L/min through face mask. After confirming the adequacy of the block, surgery was started. Whole surgical procedure lasted for 2 hours 15 minutes. Throughout the procedure patient was verbally responsive with a RAMSAY sedation score of <3 and a VAS score of  $\leq 3$ . No intraoperative complications noted & throughout

the procedure patient was haemodynamically stable. Patient was shifted to ICU for observation and was closely monitored for signs and symptoms of hypocalcemia. Patient's VAS score recorded 2 hours post operatively was  $\geq 4$  so rescue analgesia in the form of Fentanyl patch 25 mcg/hour was provided for the next 24 hours. No other supplemental analgesic were administered. Serum  $Ca^{++}$  and PTH levels were monitored postoperatively. Patient's postoperative course was uneventful, he was started on oral calcium on the second postoperative day. He was subsequently discharged home after a week.

## Discussion

Primary hyperparathyroidism often remains asymptomatic in many patients. Hypercalcemia is the underlying cause for the signs and symptoms in a hyperparathyroid patient. In these patients stress or illness may precipitate a Hyperparathyroid Crisis [7]. An acute hyperparathyroid crisis raises the serum calcium level acutely above 14 mg% with, nearly 4 times higher PTH levels. Clinical manifestations include weakness, lethargy, hypertension, palpitations, polyuria, polydipsia, anorexia, nausea, vomiting, dehydration, altered mental state or even coma. The best treatment for hypercalcemic crisis is early diagnosis and proper medical management followed by removal of hyperfunctional glandular tissue at a later stage [8]. Medical management comprises of adequate intravenous hydration, diuresis, Bisphosphonates and dialysis in cases refractory to medical management. Criteria for surgery in these patients include significant hypercalcemia ( $> 1$  mg/dl above upper limit of normal), marked hypercalciuria ( $> 400$  mg/day), low bone density, unexplained renal insufficiency and episode of acute primary hyperparathyroidism [9]. Consideration for parathyroidectomy should also be given to elderly patients with primary hyperparathyroidism who are vitamin D deficient. Our patient presented with generalized muscular weakness, lethargy and gave history of 2 episodes of hypercalcaemic crisis within a span of last 30 days, requiring hospital admission. Parathyroidectomy was indicated in our patient because of the persistently elevated serum calcium levels, regular episodes of life threatening hyperparathyroid crisis.

In patients of Parathyroid adenoma presenting with hyperparathyroid crisis, emergency parathyroidectomy has a success rate of 92% with excellent long term outcome [10,8]. Usually parathyroid gland surgeries are performed under GA.

However the cervical plexus block/local anaesthesia techniques has been shown to be safe, with cure rates equivalent to GA [11,12]. However the studies available till now on local versus general anaesthetic approach for parathyroidectomies do not yield definitive information, regarding which technique is superior. However operating under local anaesthesia keeps patient fully conscious, hence surgeon can easily communicate as well as assess the phonation of patient. Our patient was operated using regional anaesthesia technique combining superficial with deep cervical plexus block and excellent analgesia and anaesthesia of the operative site was achieved.

Ziegler R et al [13] noted that there is a risk of life threatening cardiac arrhythmias when severe hypercalcemia is not treated preoperatively in these patients. As such there are no guidelines regarding the preoperative serum calcium levels in these patients. Hypercalcemia along with associated muscular weakness was another reason why we preferred regional anaesthesia technique in our patient.

Cervical plexus block anaesthetises the motor and sensory nerves originating from C2 to C4 nerve roots [14]. The SCPB is used for superficial cutaneous surgeries of the head and neck whereas the DCPB is used for deeper surgeries of the neck, such as carotid artery or thyroid surgery. This block is also useful to supplement other regional techniques of the upper torso [14]. Studies have shown that superficial cervical plexus block with local infiltration is as effective as a combined superficial and deep cervical plexus block. Still many clinicians perform a SCPB to complement the DCPB [14,15] to achieve complete anaesthesia and avoid possible failure of the block. We performed a combined superficial and deep cervical plexus block to ensure complete anaesthesia. We used a single injection technique for DCPB in our patient as he was on Tab Aspirin.

Black M J et al [16] showed that parathyroidectomies done under regional anaesthesia significantly reduced post-operative pain, nausea, and vomiting in patients. Sang Yoon et al [17] reported successful management of parathyroidectomy under superficial cervical plexus block in a patient with severe kyphoscoliosis. Our patient had no episodes of hypocalcaemia, nausea and vomiting postoperatively with reduced postoperative analgesic requirement.

Perioperative management of symptomatic heart disease in patients undergoing non cardiac surgery requires careful team work and communication between patient, primary care physician,

anesthesiologist and surgeon. Several cardiac indices are present to predict postoperative cardiac complications in these patients. Our patient was to undergo an intermediate risk surgery, he had major clinical predictors positive for post-operative cardiac complications with GOLDMAN MULTI FACTORIAL CARDIAC RISK INDEX score [18] revealing CLASS 2 with 7 to 11% post-operative risk. Goldman first reported aortic stenosis as an independent predictor for life threatening cardiac complications during non-cardiac surgery [18] and this was confirmed by Detsky [19]. Perioperative mortality and nonfatal myocardial infarction was higher in patients with Aortic stenosis [20]. Anaesthetic plan in our patient was formulated keeping in mind the associated comorbidities like ischaemic heart disease, aortic stenosis, chronic kidney disease, cervical spondylosis along with hyperparathyroidism. Generally these patients are in a state of low fixed cardiac output state, so haemodynamic goals in them includes maintaining a normal sinus rhythm, avoiding tachycardia, adequate volume loading, avoiding hypervolaemia and maintaining a normal systemic vascular resistance and afterload. Taking general anaesthesia for consideration, nearly all induction agents as well as inhalational anaesthetics cause generalized vasodilatation to a variable extent, causing decompensation, therefore titrating dose of all inhalational and induction agents is mandatory. Maintenance of intraoperative blood pressure at pre-induction levels prevents intraoperative cardiac ischaemia. Adequate analgesia maintaining a proper plan of anaesthesia intraoperatively specially during the time of intubation prevents catecholamine induced tachycardia, hypertension and the risk of cardiac ischaemia. Taking into consideration the problems related with general anaesthesia for such cases, performing the operation under regional nerve blocks with or without sedation is a good alternative. It has the following advantages of offering excellent hemodynamic stability in terms of cardiac output and systemic vascular resistance, adequate sensory and motor blockade of the operative site, decreased incidence of intraoperative tachycardia and arrhythmias, avoiding problems related to difficult airway and intubation with decreased requirement of supplemental analgesics. All these advantages prompted the use of cervical plexus block in our patient. Anesthetic toxicity, intravascular injection, phrenic nerve block etc being the main complications of cervical plexus blocks which can be detected by closely monitoring.

Intraoperative invasive arterial blood pressure

monitoring is helpful in patients with multiple comorbidities especially for long surgical procedures. Adequate fluid balance is essential, especially CVP, Oesophageal Doppler, Trans-thoracic/oesophageal Echocardiography guided fluid therapy may be helpful. Treating hypotension using directly acting alpha-agonists such as phenylephrine may improve systolic and diastolic LV function. Arrhythmias must be treated promptly. Postoperative ICU care is mandatory for these patients. We did not use invasive monitoring as the operative duration in our patient was short, no episodes of arrhythmia, ischaemia or hypotension occurred intraoperatively. Post-operatively he was shifted to ICU for observation.

Adequate preoperative assessment and proper anaesthesia technique selection followed by adequate postoperative care monitoring for hypocalcemia helped us in successful management of this patient. Serum calcium was monitored at regular postoperative intervals. Oral calcium therapy was started on 2<sup>nd</sup> postoperative day.

## Conclusion

Elderly patients of hyperfunctional parathyroid adenoma who have associated comorbidities pose a challenge to the anaesthetist. Setting up anaesthetic goals along with a detailed anaesthetic plan which could be curtailed as per patient's requirement is mandatory for them. Preoperative optimization of patient, maintenance of adequate hydration status and keeping ionized calcium within normal limits during perioperative period can reduce potential complications. Parathyroidectomy under combined superficial and deep cervical plexus block is an acceptable regional anaesthetic technique and provides effective analgesia with limitation of side-effects, but such technique can be extremely hazardous in light of inadequate anaesthesia. As it requires considerable practice and skill in recognition of anatomical structures and placement of the needle.

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