

# Concomitant off-pump coronary artery bypass grafting and total thyroidectomy for a large retrosternal goitre: a case report and review of the literature

Savvas Lampridis, Man Chi Lau, Peter Mhandu, Haralabos Parissis

Department of Cardiothoracic Surgery, Royal Victoria Hospital, Belfast, UK

Correspondence to: Savvas Lampridis, Department of Cardiothoracic Surgery, Royal Victoria Hospital, 274 Grosvenor Road, Belfast, BT12 6BA, UK.

Email: savvas.lampridis@gmail.com.

**Abstract:** A 76-year-old male presented with angina and a large retrosternal goitre causing marked dyspnoea. Coronary angiography revealed triple vessel disease and moderately impaired left ventricular function. CT imaging demonstrated a substantial multinodular goitre extending into the posterior mediastinum to the level of the carina, with associated compression of the trachea and oesophagus. Preoperative thyroid function tests showed euthyroid state. The patient subsequently underwent off-pump coronary artery bypass grafting (OPCABG) ×2 with concomitant total thyroidectomy. A thyroid mass of dimensions 19 cm × 16 cm × 5.5 cm and weight 439 g was confirmed to be a multinodular goitre. Postoperative complications included bilateral recurrent laryngeal nerve damage, hypocalcaemia and ventilator-associated pneumonia. The patient was discharged 36 days postoperatively and remained asymptomatic at 1 year follow up. This case provides further evidence that concomitant OPCABG and thyroidectomy for the treatment of large retrosternal goitre can be safely and effectively performed, provided that perioperative levels of thyroid hormones are maintained at euthyroid or hypothyroid levels.

**Keywords:** Off-pump coronary artery bypass grafting (OPCABG); total thyroidectomy; retrosternal goitre; multinodular goitre

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## Introduction

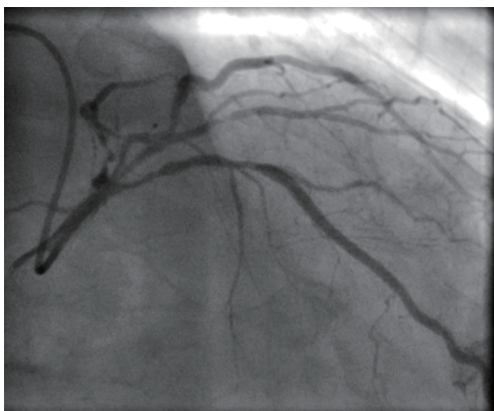
Retrosternal goitre results when a proportion of at least 50% of the thyroid gland descends into the mediastinum. The documented incidence ranges from 0.02–0.5% in the general population and 2.6–21% in thyroidectomy patients, accounting for 3–12% of all mediastinal tumours (1,2). Clinical presentation may be associated with manifestations of thyroid dysfunction, as well as tracheal and oesophageal compression symptoms. Sternotomy is the indicated surgical approach if the retrosternal portion is large, thyroid tissue extends below the level of the aortic arch, invasive malignancy is likely or confirmed, or if there is existing adherence to surrounding mediastinal structures (3,4).

Thyroid disease affects cardiovascular physiology, presenting in up to 11% of patients with coronary artery or

valvular heart disease (5). Whilst concomitant cardiac and thyroid procedures have been discussed in literature, no consensus exists regarding the optimal surgical management of such cases. Herein, we present a case of simultaneous off-pump coronary artery bypass grafting (OPCABG) and total thyroidectomy, followed by a review of the current literature on this subject. It is our view that in patients displaying severe cardiac ischaemia in conjunction with retrosternal goitre, concomitant CABG and thyroidectomy is the treatment of choice.

## Case presentation

A 76-year-old male presented with sudden onset precordial pain. Relevant past medical history included angina pectoris



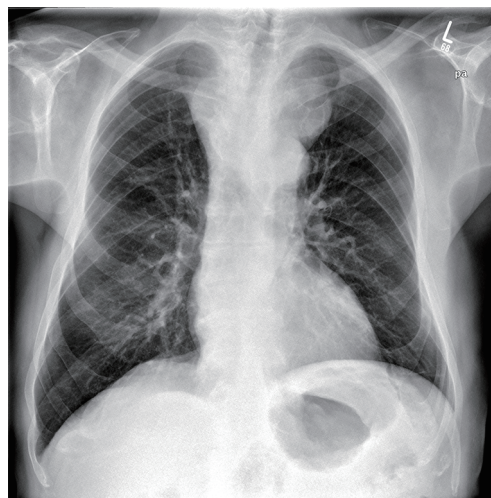
**Figure 1** Coronary angiography demonstrating occlusive lesions of the left anterior descending artery, the first diagonal branch and the circumflex artery.



**Figure 2** Coronary angiography revealing diffuse disease of the right coronary artery.

(Canadian Cardiovascular Society Grade I) and dyspnoea (New York Heart Association Functional Class III). In addition, the patient suffered from stage III chronic kidney disease, type 2 diabetes mellitus, hyperlipidaemia and severe bilateral knee osteoarthritis. Previous procedures included transurethral resection of the prostate and bilateral inguinal hernia repair. With respect to social history, he was a lifelong non-smoker.

On admission, electrocardiogram showed new left bundle branch block, with troponin level within normal range. The patient underwent coronary angiography with the following findings: The left main stem (LMS) had no significant disease, but was calcified. The left anterior descending artery (LAD) was 80–90% proximally occluded,



**Figure 3** Chest radiograph showing significant superior mediastinal enlargement.

with a severe lesion in the large first diagonal branch and a less severe lesion located distally. The left circumflex artery had a severe proximal occlusive lesion just before the first obtuse marginal branch (*Figure 1*). The right coronary artery (RCA) was diffusely diseased with a 40–50% lesion in the mid-vessel and an 80–90% occlusion before the crux (*Figure 2*). A left ventricular angiography demonstrated anterior wall hypokinesia and moderately impaired left ventricular function.

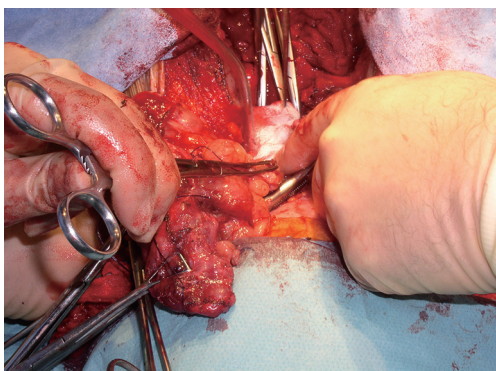
Chest radiograph had revealed superior mediastinum enlargement (*Figure 3*) and a subsequent CT scan of neck, chest and abdomen showed a large, calcified, multinodular goitre descending into the posterior mediastinum to the level of the carina. It displaced the great vessels, trachea and oesophagus to the right, compressing both of the latter structures (*Figure 4*). Pulmonary function tests revealed forced expiratory volume in 1 second (FEV<sub>1</sub>) 117%, forced vital capacity (FVC) 122% and peak expiratory flow rate (PEFR) 79%.

Due to the goitre location, a cardiac procedure with endocrine surgical input was planned. Preoperative assessment revealed left recurrent laryngeal nerve palsy and thyroid function tests showed euthyroid state. EuroSCORE values were an additive score of 9 and a logistic score of 13.71. A Parsonnet score of 19 (hard data) was determined.

The patient underwent concomitant OPCABG ×2 with total thyroidectomy, with the endocrine component of the operation performed first. A median sternotomy incision was made, to which a subsequent 6 cm transverse incision



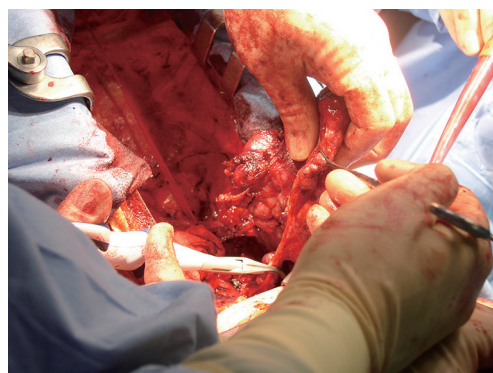
**Figure 4** Axial computed tomography of the chest displaying a huge, multinodular goitre extending into the posterior mediastinum. It displaces the trachea and oesophagus to the right, compressing both these structures, and contains several areas of calcification.



**Figure 5** Mobilisation of the left thyroid lobe.

was joined to form a ‘T’ shape. Following division and lateral retraction of strap muscles, each thyroid lobe was approached separately and excised with division of the isthmus (*Figures 5,6*). After ligation and division of the superior thyroid vessels, the upper pole was mobilised. The superior parathyroid glands were identified and fully preserved. No middle thyroid vein was visualised. The lower pole was mobilised in a corresponding manner. Separation of the thyroid from the trachea, oesophagus and surrounding structures was then completed. Due to a difficult anatomical dissection, damage was incurred to both recurrent laryngeal nerves.

An intra-aortic balloon pump was inserted prior to the cardiac aspect of the operation. No cardiopulmonary bypass



**Figure 6** Mobilisation of the right thyroid lobe.

or cross-clamping of the aorta was implemented and the core temperature was sustained at 37 °C. Only 1 mg/kg body weight of heparin was administered intravenously, in order to minimise bleeding from the extensive raw mediastinal surfaces. Saphenous veins were not suitable for grafting. The patient underwent pedicled left internal mammary artery grafting to LAD and radial artery to distal RCA, with the proximal end of the radial artery anastomosed on the aorta. Ventricular pacing wires were placed and closure was carried out in layers, with the sternum approximated using three loop stainless steel wires.

Cardiac surgery ICU and HDU recovery period lasted 26 days. The patient was commenced on thyroid hormone replacement therapy and calcium and vitamin D supplements. Sequelae included a failed extubation on day two due to bilateral vocal cord palsy, and resultant prolonged endotracheal intubation, with a tracheostomy performed on day 8. An extended ventilator-weaning period necessitated the commencement of nasogastric feeding between days 13–25. Other postoperative complications included ventilator-associated pneumonia, initially treated with piperacillin/tazobactam and subsequently changed to meropenem following sensitivity results. Anaemia required transfusion of 2 units of packed red blood cells. As the patient also exhibited transient hypertension and frank haematuria, outpatient flexible cystoscopy was arranged as per urology review. On day 26 the patient was transferred to the care of the otolaryngology team. He remained in hospital for a further 10 days and was then discharged.

The thyroid was subject to pathological examination. The gland was of substantial size, weighing 439 g and measuring 19 cm × 16 cm × 5.5 cm. A multinodular appearance was noted with respect to both lobes (*Figure 7*). Histological examination showed considerable variation in





**Figure 7** The excised multinodular goitre of dimensions 19 cm × 16 cm × 5.5 cm.

follicular size and colloid content with small areas of fibrosis and dystrophic calcification. There was no evidence of malignancy.

At 1-year follow up the patient remained asymptomatic. The right vocal cord function had improved and tracheostomy had since been reversed. The patient was confirmed to be euthyroid and was discharged from both cardiac and endocrine surgical care.

## Discussion

In general, combined cardiac surgery and thyroidectomy is regarded as a safe and efficacious procedure with good clinical outcomes. A recent review of the existing literature determined 16 key papers (3 retrospective case series and 13 case reports) on this topic (6). However, of a total cohort of 32 patients, only four underwent concomitant OPCABG with total thyroidectomy for a retrosternal goitre. In the first report, Mehta *et al.* (7) documented the case of a 66-year-old female with unstable angina (LMS disease) and severely compromised airway secondary to a multinodular retrosternal goitre. Initially, a subtotal thyroidectomy was performed, followed by OPCABG with saphenous vein grafts to the LAD and the ramus intermedius, with the absence of intraoperative complications. Following a slow ventilator-weaning period, the patient was returned to theatre for extubation under general anaesthesia, due to development of post-intubation tracheomalacia. The patient was discharged on the 8th day postoperatively, with normal respiratory and cardiac function and euthyroid hormone levels. In the second case report, Mehra *et al.* (8) performed

combined OPCABG and thyroidectomy on a 70-year-old woman with extensive coronary artery disease, involving the LMS, and tracheal compression as a consequence of a retrosternal goitre. They reported a successful procedure, with no resultant postoperative complications. As a consequence of this combined approach, normal cardiovascular function and upper airway patency were established, with the patient discharged on postoperative day 10. In the third case report, this same combined procedure was performed on a 57-year-old female with coronary artery disease, which included 95% in-stent restenosis of the LAD, accompanied by a large retrosternal goitre (9). The reported postoperative period was uneventful and the patient was discharged 5 days later. Finally, in one case from the retrospective series reported by Testini *et al.* (10), a total thyroidectomy followed by CABG was performed. All the cases from the aforementioned 16 key papers which involved a combined procedure of isolated CABG and thyroidectomy are presented in *Table 1*.

This paper has presented a case involving the single-procedure treatment of two significant diseases of differing pathology, namely severe myocardial ischaemia and retrosternal goitre causing displacement and compression of adjacent structures. Both for our patient and in a wider context, the combined approach exhibits various advantages. Firstly, the anatomical proximity of the thyroid facilitates its excision in conjunction with CABG, making this a feasible surgical option (5). Furthermore, the cumulative risk of a combined operation seems to be less than the individual risks associated with each separate procedure and also avoids the need for re-sternotomy (15). A stand-alone thyroidectomy preceding CABG subjects a patient with coexisting coronary artery disease to significant risk associated with the use of general anaesthesia. Conversely, an independently performed CABG prior to thyroidectomy cannot address goitre-related respiratory dysfunction and may result in a problematic and prolonged ventilator-weaning period. Moreover, CABG as an initial stand-alone procedure in cases of hyperthyroidism could lead to undesirable arrhythmias complicating the postoperative recovery period (5). In our case, an off-pump approach was preferable due to the patient's increased age and impairment of left ventricular function. A significant advantage of OPCABG is the use of lower heparin doses relative to on-pump procedures, which reduces the risk of bleeding, especially from the highly vascularised thyroid (16).

In conclusion, it is our view that a simultaneous, dual discipline approach combining OPCABG and

**Table 1** Combined procedure of isolated coronary artery bypass grafting and thyroidectomy

Author, year, country	Age, gender, clinical presentation	Cardiac pathology	Thyroid pathology (thyroid function)	Operation	Outcomes
Cetin <i>et al.</i> , 2014, Turkey (9)	57-year-old female: cough	95% in-stent restenosis of LAD	Retrosternal goitre (euthyroid)	Subtotal thyroidectomy followed by OPCABG x1	Successful operation. Nil postoperative complications. Patient discharged on day 5 with euthyroid hormone levels. Well at 6-month follow-up
Gürkan <i>et al.</i> , 2012, Turkey (11)	65-year-old male: asymptomatic	Sub-occlusive lesion of RCA and Cx, total proximal occlusion of LAD	Retrosternal multinodular goitre (euthyroid)	Subtotal thyroidectomy followed by CABG x3	Nil intra- or post-operative complications. Patient discharged on day 7 with euthyroid hormone levels
Koçak <i>et al.</i> , 2007, Turkey (12)	47-year-old male: angina, dyspnoea, limitation of cervical movements	Coronary artery disease (no further details documented)	Multinodular goitre (hypertthyroid)	Total thyroidectomy followed by CABG x3	Nil intra- or post-operative complications. Patient discharged on day 9 with euthyroid hormone levels. Well at 1-year follow-up
Litmathe <i>et al.</i> , 2004, Germany (13)	67-year-old male: angina, dyspnoea	Coronary artery disease (no further details documented)	Multinodular goitre (euthyroid)	Goitre resection and CABG with LIMA (no further details documented)	No symptoms of cardiac ischaemia at follow-up (no further details documented)
Mehra <i>et al.</i> , 2009, India (8)	65-year-old male: angina, dyspnoea	Coronary artery disease (no further details documented)	Retrosternal multinodular goitre (euthyroid)	Goitre resection and CABG with LIMA (no further details documented)	Intraoperative death
	70-year-old female: myocardial infarction, dyspnoea, cachexia, anaemia	80% occlusion of LMS, 70% proximal stenosis of LAD, 30–40% ostial narrowing of Cx, 80% occlusion of RCA	Retrosternal multinodular goitre causing tracheal compression (euthyroid)	OPCABG x3 followed by total thyroidectomy	Nil intra- or post-operative complications. Patient discharged on day 10 with euthyroid hormone levels. Well at 6-month follow-up

**Table 1** (continued)

Table 1 (continued)

Author, year, country	Age, gender, clinical presentation	Cardiac pathology	Thyroid pathology (thyroid function)	Operation	Outcomes
Mehta <i>et al.</i> , 2005, India (7)	66-year-old female: angina	Double vessel disease with 60% stenosis of LMS	Retrosternal multinodular goitre causing significant tracheal stenosis (hypothyroid)	Subtotal thyroidectomy followed by OPCABG x2	Nil intraoperative complications. Patient returned to theatre for extubation under general anaesthesia, following post-intubation tracheomalacia; discharged on postoperative day 8 with euthyroid hormone levels
Testini <i>et al.</i> , 2010, Italy (10)	51-year-old female: dysphagia	Coronary artery disease (no further details documented)	Goitre (euthyroid)	Total thyroidectomy followed by CABG	All five operations were successful. Transient recurrent laryngeal nerve palsy in one case. Nil complications over 2- to 14-month follow-up
	65-year-old male: asymptomatic	Coronary artery disease (no further details documented)	Retrosternal goitre (euthyroid)	Total thyroidectomy followed by CABG	
	69-year-old male: thyrotoxicosis	Coronary artery disease (no further details documented)	Retrosternal goitre (hyperthyroid)	Total thyroidectomy followed by CABG	
	70-year-old female: dysphagia	Coronary artery disease (no further details documented)	Toxic retrosternal goitre (hyperthyroid)	Total thyroidectomy followed by CABG	
	59-year-old male: asymptomatic	Coronary artery disease (no further details documented)	Goitre (euthyroid)	Total thyroidectomy followed by CABG	
Wexler <i>et al.</i> , 2011, USA (14)	76-year-old female: myocardial infarction, dyspnoea	Severe proximal stenosis of LAD, bifurcating lesion of diagonal artery	Retrosternal multinodular goitre causing tracheal compression (euthyroid)	Total thyroidectomy followed by CABG x2	Nil intra- or post-operative complications. Patient discharged on day 9. No cardiac or thyroid complications present at 6-week follow-up

CABG, coronary artery bypass grafting; Cx, circumflex artery; LAD, left anterior descending artery; LMS, left main stem; OPCABG, off-pump coronary artery bypass grafting; RCA, right coronary artery.

thyroidectomy for a retrosternal goitre can be safely and effectively performed to achieve good clinical outcomes, provided that perioperative levels of thyroid hormones are maintained at euthyroid or hypothyroid levels.

### Acknowledgements

None.

### Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

*Informed Consent:* Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

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