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# A Typical Case of Compressive Euthyroid Plunging Goiter with Agenesis of the Isthmus and Right Thyroid Lobe Revealed by BPPV in A 72-Year-Old Woman: Literature Review

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## ABSTRACT

***Introduction:*** *Thyroid hemiagenesis is a rare congenital anomaly, with prevalence between 0.02 and 0.2%, affecting the thyroid gland and resulting from a defect in the embryological development of one of the two thyroid lobes. The majority of cases of thyroid hemiagenesis are associated with euthyroidism but have almost never been discovered in a case associated with a plunging goiter, nor in the context of associated vertigo.*

***Methods and Results:*** *We report a 6-month prospective descriptive study of an atypical case in a 72-year-old female patient who presented for vertigo and cough in the left lateral decubitus position. The physical examination suggested benign paroxysmal positional vertigo. A fortuitous chest X-ray, then cervicothoracic MRI, thyroid ultrasound, cervical Doppler ultrasound, and thyroid hormone assessment revealed the association of right isthmo-lobar agenesis with a polycystic, multinodular, compressive, plunging goiter in euthyroidism. Intraoperatively, the large goiter was engaged in the mediastinum and compressed the left common carotid artery and the left jugular vein, pushing the trachea to the right. The gland presented agenesis of the isthmus and right thyroid lobe. We proceeded by dissection and resection of the single left superior pedicle, exteriorization of the left lobe and dissection of the left recurrent nerve until complete extirpation of the lobe. The anatomopathological analysis of the specimen revealed a benign multinodular and polycystic colloid goiter. The immediate postoperative course and late follow-up at 12 months postoperatively were simple.*

***Conclusion:*** *In the context of a left lateral decubitus cough with paroxysmal positional vertigo on left posterior cephalic mobilization; without obvious clinical signs of a cervical mass, it is not easy to make the diagnosis of a compressive plunging goiter. The diagnosis of associated right isthmo-lobar agenesis is only possible by incidental medical imaging or intraoperatively. Radical treatment with a good prognosis is essential, and the only option is surgery.*

**Keywords**
Benign paroxysmal positional vertigo, Thyroid agenesis, Compressive plunging goiter.

## Introduction

The thyroid gland is a butterfly-shaped organ lying in the anterior aspect of the neck, which has the major function of producing thyroid hormones, namely triiodothyronine and tetraiodothyronine [1]. This gland can enlarge due toseveral physiological or pathological stimuli, and it can become high in volume, called goiter. The term goiter is usually used to denote cervical goiter and can be associated with euthyroidism, hypothyroidism, or hyperthyroidism [2]. Goiter is a significant public health problem, particularly in underdeveloped countries [3]. Thus, it can usually developed anteriorly in the neck because the growing thyroid is not limited by anterior cervical muscles, subcutaneous tissue, or skin. If the thyroid gland develops inferiorly and crosses the thoracic outlet, it is called a substernal or retrosternal goiter [4].

Plunging goiter is a localized or widespread enlargement of the thyroid gland that infiltrates behind the sternum and is partially or completely in the mediastinum, with the lower limit not palpable in the surgical position [5]. When there is no obvious cervical mass and the clinical examination is not sufficiently revealing, its diagnosis becomes challenging [6]. Even in the absence of clinical signs, multidisciplinary surgery is the preferred treatment due to the risk of compressive complications, cancer, and even subite death [7]. According to published research, the morbidity rate following compressive goiter surgery ranges from 4% to 12%. These risks include recurring nerve damage, hypoparathyroidism, and breathing issues associated with a compressive hematoma or tracheomalacia, which is an uncommon consequence [8]. A variety of morphological changes and developmental abnormalities, including as hypoplasia, ectopy, hemiagenesis, and agenesis, can also affect the thyroid gland [9]. In 1895, Marshall Harado et al. published the first description of the unusual defect known as the solitary thyroid lobe. He stated that seven cases out of 12456 thyroid operations were carried out over a 13-year period [10]. Unilateral or bilateral hypoplasia or agenesis of one or both thyroid lobes, with or without isthmic agenesis, is a rare developmental anomaly [11]. The prevalence of thyroïdienne hemogenetics is estimated to be between 0.02 and 0.2%, and it is typically found after imaging or surgery on a patient [12]. So, Various thyroid disorders could have an impact on BPPV; like hypothyroidism; thyroiditis, and hyperthyroidism [13,14]. A sudden and unusual sense of motion and/or rotational vertigo that lasts less than a minute and is accompanied by the distinctive nystagmus is known as benign paroxysmal positional vertigo (BPPV) [15]. Vertigo is brought on by otoliths that separate from the utricle and enter the semicircular canals. Head positional shifts cause symptoms, which can vary from moderate dizziness to incapacitating episodes that may cause nausea or vomiting [16]. Although its etiopathogenesis is still unclear, peripheral vestibular dysfunction is the condition that affects people the most globally. Given the variety of etiologies, some research emphasizes the link between BPPV and thyroid conditions such as [14]. There is an association between various other systemic or inner ear conditions and BPPV has been reported, indicating the existence of secondary BPPV [17]. It is example of few previous studies reported the association of BPPV with hyperthyroidism and Hashimoto's thyroiditis [18,19]. So, Various thyroid disorders could have an impact on BPPV. However, most cases of thyroïdienne hemo-ageneses are linked to a euthyroïdie, was reported no symptoms, and the condition is discovered incidentally during investigations or intraoperatively [20,21]. However, thyroid-related lobary thyroid disease has hardly ever been found in a case linked to a plonging goiter or in a vertigo setting [13]. But plunging goiter can be also one of the commonest causes for vertigo. Therefore, goitre and thyroid-related aggression can be detected fortuitously during imaging or thyroid surgery, where the clinic can simply simulate a VPPB [5,22]. The goal is to report this unusual case of a VPPB that reveals a unilobed, compressive, left goiter.

## Clinical Presentation

A 72-year-old female patient with no particular medical history was seen at the "Centre Medical les Promoteurs de la Bonne Santé" (Yaoundé, Cameroon) on October 11, 2024, for paroxysmal rotary vertigo that had been developing for approximately 6 weeks prior to the consultation. The vertigo lasted approximately 30 seconds, was triggered in the left lateral decubitus position and worsened when turning the head to look to the left side, and progressed intermittently. Associated signs included a dry cough and respiratory difficulty in the left lateral decubitus position; however, there were no other associated otological symptoms. She had not taken any medication until then.

On physical examination, she presented in good general condition, a good level of consciousness, and stable hemodynamic parameters with:

BP: 135/85mmhg Pulse: 76Ppm FR: 19 Cpm SPO2: 99% Temp: 37°C Weight: 68 kg

The neuro-otological examination was normal. However, on the Dix-Hallpike test, she reported severe dizziness when her head was tilted to the left side, and a horizontal nystagmus to the right was observed on the videonystagnoscope. The patient could not remain with her face turned to the left for more than 15 seconds. She stopped feeling dizzy when her head was turned to the left side. The Epley maneuver could not be performed because the patient was unable to tolerate it. The remainder of the ENT, cervical, and nasofibroscopic examinations were nearly normal (Figure 1).

**Figure 1:** The patient's neck appeared at the first consultation, revealing no swelling.

The cardiopulmonary examination was normal. We concluded that she had benign paroxysmal positional vertigo.

She was prescribed rehabilitation maneuvers such as the Brandt-Daroff exercise, to be performed in bed at home, at a frequency of one exercise of 5 minutes repeated 5 times in a row, 3 times per day, for about 2 weeks, or until there is no more dizziness with the exercise.

A chance chest X-ray revealed a homogeneous opacity with superior mediastinal widening, with a clear deviation of the tracheal airway axis to the right, raising suspicion of a mediastinal mass (Figure 2).

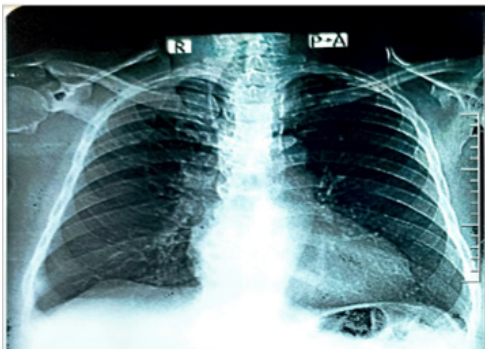


**Figure 2:** Frontal chest X-ray: Homogeneous mediastinal opacity and tracheal deviation to the right between T1 and T4 (blue arrow).

We performed a cervicothoracic MRI, which revealed a plunging goiter with a single left thyroid lobe, without an isthmus. A left cervicothoracic mass originating from the ipsilateral thyroid lobe was identified, with a T1-weighted hypointense signal and a T2-weighted hyperintense signal, measuring 63 mm in height and 66 x 36 mm in the axial plane. The mass pushed the trachea toward the contralateral side and extended left thoracic area, compressing adjacent vascular structures, including the common carotid artery and the ipsilateral jugular vein; the lymph nodes were free, and there were no thoracic consolidations or suspicious thoracic nodules.

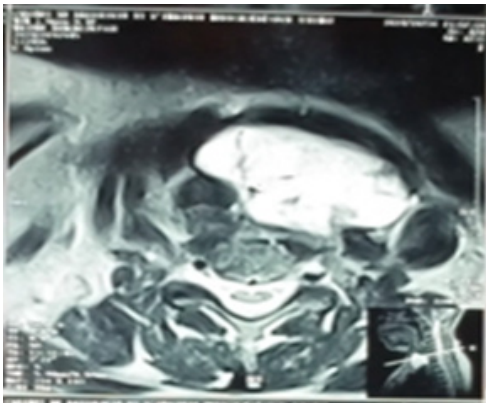

**Figure 3:** Cervico-thoracic MRI in axial section showing the hypersignal of a left cervico-thoracic mass originating on the homolateral thyroid lobe T2 measuring 66x36 mm on the axial plane.

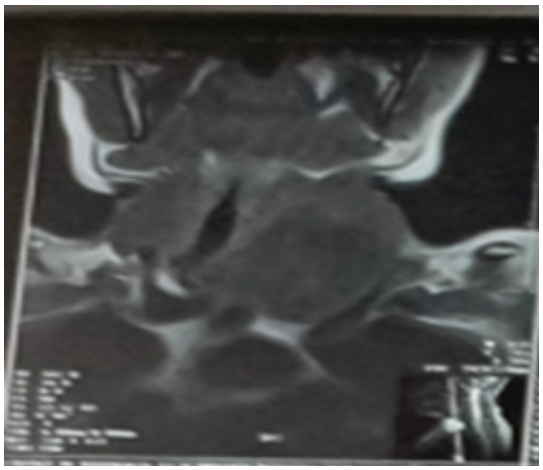

**Figure 4:** Cervical-thoracic MRI in frontal section showing the mediastinal extension of the single left lobe of the thyroid.

A thyroid ultrasound and cervical Doppler ultrasound revealed: a heterogeneous left unilobar thyroid mass, with no visible inferior demarcation, predominantly isoechoic, with a non-visible inferior pole, with nodular portions measuring 50 mm and cystic portions measuring 52x47x4 mm, or 76 ml, with regular contours, with vascular corbeling on color Doppler, classified EUTIRADS 3 (according to the EUTIRADS 2017 classification). Morphological and velocimetric studies of the supraoptic trunks were normal. The mass slightly compressed and pushed back the left common carotid artery. The right lobe and thyroid isthmus were not visible. Furthermore, there were no muscular, vascular, fatty tissue or cervical visceral abnormalities: no cervical adenopathies.

Thyroid hormone assessment demonstrated euthyroid function: FT3: 5.65 (2.8 - 7.1) pmol/L FT4: 15.91 (12-22) pmol/L TSH: 1.19 mUl/L Thyroglobulin: 65.10 (3.5 - 77) µg/L Calcitonin: 3 (N: < 10 ng/L).

Anti-thyroglobulin antibodies: 17 IU/ml (N: < 115 IU/ml) Anti-peroxidase antibodies: <15 IU/ml (N: < 34 IU/ml) Serum calcium: 90 mg/L. Examination of the fine needle aspiration cytology of the thyroid mass was in favor of a cytopathological appearance of a nodular, cystic goiter, classified EUTIRADS 3. No evidence of atypical or malignant cells was found.

The indication for a left lobectomy was established. The surgery was performed in a multidisciplinary team involving a head and neck surgeon and a cardiothoracic surgeon. The procedure was performed under general anesthesia.

## Surgery

The lower limit of the goiter was difficult to access at the start of the procedure, despite the hyperextended neck position. The two-finger-width marker was not respected during the incision.

And we had to make the transverse incision almost at the edge of the sternal manubrion to gain ample access to the mass.

We made a 7 cm supraxiphoid incision, in the form of a Kocher tie on the cutaneous and subcutaneous layers. After detaching the upper and lower skin flaps, the white line was identified and opened. The infrahyoid muscles were retracted, allowing exposure of the thyroid space and dissection in contact with the capsule. A large, plunging left lobar goiter was discovered, compressing the left carotid artery and left jugular vein, largely located in the mediastinum. The gland showed agenesis of the isthmus and right thyroid lobe (Figure 5). The next step consisted of dissection of the superior pole, providing access to the retro thyroid plane and the lateral aspect of the lobe.

The continuation of the intervention was the dissection of the left recurrent nerve, located at the point of intralaryngeal penetration, where the cricoid cartilage is located by vision and lying down. The dissection of the posterior surface begins at the superior pole of the lobe in contact with the capsule, progressing from top to bottom, allowing the cricopharyngeus muscle to be highlighted. The lower edge of this muscle, arranged in a scarf, around the cricoid cartilage opposite the point of penetration of the nerve. To make the dissection area more accessible, we proceeded to the section of all the tracheal attachments of the lobe, which allowed the lobe to be mobilized. The isolation of the single superior left pedicle, clamped by the forceps at the level of the thyroid capsule, resected then ligated between mounted forceps (Figure 6). A traction wire was placed at the superior pole, allowing exteriorization of the thyroid lobe to access the left recurrent nerve search area. Subsequently, to isolate the inferior thyroid vessels, we made the cautious ascent and delivery of the goiter, the index finger placed in contact with the capsule, and running along the external face of the lobe to its lower edge which it goes around and goes up on the anterior face under the thyropericardial lamina, behind the sternal manubrium in which the inferior thyroid vein was located.

We monitored potential bleeding from mediastinal vessels. Once the inferior pole was freed, we then located the left recurrent nerve at its intersection with the left inferior thyroid vein and followed it until it entered the tracheoesophageal dihedral angle. Hemostasis was securely established between two inferior thyroid vein ligatures. Subsequently, the thyroid body was tilted toward the midline, and dissection of the recurrent nerve was continued until it entered. During this dissection, the left parathyroids were identified and, of course, preserved along with their vascularization. The left lobe was completely separated from the laryngotracheal axis. Hemostasis of the posterior branches of the superior pedicle Good vascularization of the superior parathyroid gland was obtained. The left superior pedicle was isolated, clamped flush with the thyroid capsule, subsequently resected and ligated between mounted clamps (Figure 6). A traction wire was placed on the superior pole, allowing exteriorization of the thyroid lobe to access the search area of the left recurrent nerve.The single left lobe contained several nodules (Figure 7).

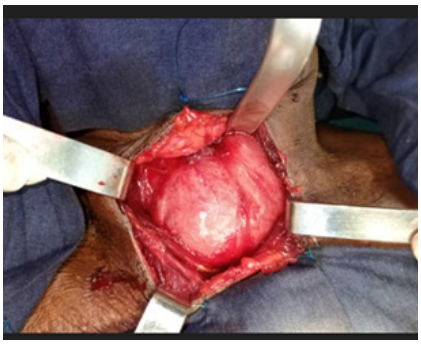

**Figure 5:** Large, plunging left lobar goiter, Compressive, with agenesis of the isthmus and right lobe.

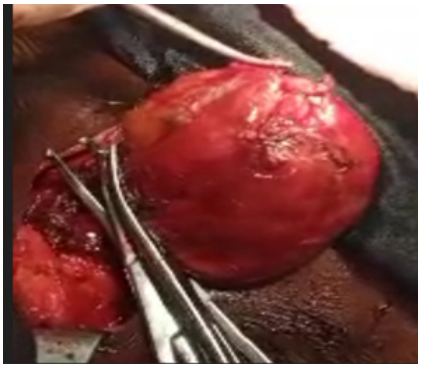

**Figure 6:** Single clamped pedicle of the left lobe.

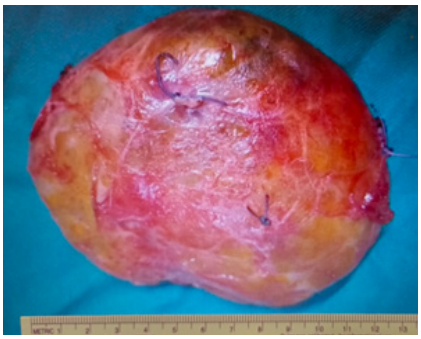

**Figure 7:** Macroscopic appearance of the surgical specimen of the goiter Multinodular and cystic with right isthmo-lobar agenesis measuring 11 cm in length.

Two suction drains had been placed in the thyroid space intraoperatively and were removed on postoperative day 2 after checking the canister, which only returned 15 cc of serosity.

She was hospitalized for 48 hours and placed on: injectable paracetamol: 1 g/8 h by infusion and nefopam 20 mg injected by IVDL every 8 hours.

The immediate and late postoperative course was uneventful, with complete improvement of dizziness and cough. Serum calcium control 48 hours postoperatively was normal at 88 mg/L.

Pathological analysis of the surgical material revealed a histopathological appearance compatible with a modified polycystic colloid goiter (multinodular), without malignancy.

Thyroid hormone control one month postoperatively showed hypothyroidism, indicating that the patient should be placed on lifelong opioid therapy. Hormonal monitoring six months after surgery showed normal hormone levels.The 12-month follow-up was normal [8].

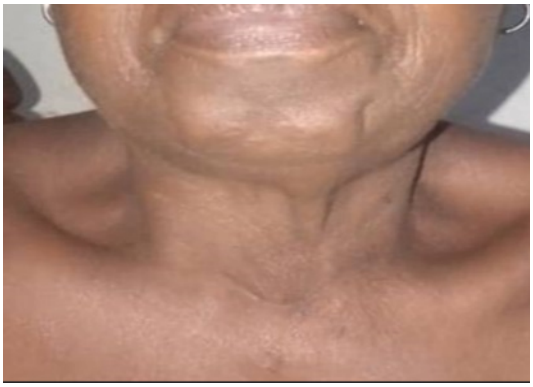

**Figure 8:** Appearance of the cervical scar 12 months in post-operative.

## Discussion

The thyroïde gland is the first endocrine gland seen during embryonic development, and it takes on its final shape and location around the end of the seventh week of pregnancy before the trachée [22]. She is made up of two symmetrical lobes joined by the isthme and is situated in front of the second and third trachéaux anneaux. Numerous morphological variants and anomalies of the thyroïde gland have been reported; these differences vary depending on sex, race, and population [20,23].

### Thyroid Hemiagenesis

When the gland's entire development fails, or just a portion of it does, it can result in unilateral, bilateral, or isthmical aggression or hémiagénésis. Its basic mechanism can be explained in an embryological manner, starting with the division above the thyroglosse canal [24]. Data on the prevalence of thyroïd aggression are primarily derived from cadaveric series, with an incidence ranging from 0.5 to 10% [25]. Thyroid hemiagenesis has an estimated prevalence of 0.02–0.2%. As in most cases of thyroid pathology, lobar hemi-agenesis is found mainly in women. Our case is a hold woman, 72 years old, whose agenesis is mainly on the right lobe and the isthmus [12]. Hemi agenesis of the left lobe is far commoner than of the right, with a left: right ratio of 4: 1. The left lobe is absent in 80 % of cases, the right is in 20 % of cases, and the isthmus in 50 % of patients [20,21]. Although thyroid hypoplasia has been associated with mutations in the thyrotropin (TSH) receptor. Mutations of chromosome 22 or variations in the thyroid transcription factor 1-2 (TITF); TTF-1, Pax 8 and TTF-2 genes or its homologous FKHL15.have been reported in to play a role in the anatomical variations of the gland [9,25].

Embryological developmental anomalies due to a high division of the thyroglossal duct can also generate two independent thyroid lobes with failure of fusion in the midline. The cause of thyroid agenesis is unknown [26]. could occur over ten years after the original pathology. If there are no symptoms, there is no need for treatment [20]. In our case study, the patient had no history of previous pathologies that could justify the present thyroid dysmorphism.

### Plunging Goiter

Goiters often develop gradually over many years, sometimes reaching the mediastinum and spreading into the visceral compartment through the thoracic inlet. In our study, the mass was not visible in the neck during the patient's physical examination. This could explain the plunging nature of the goiter [27]. Retrosternal goiters typically start in the thyroid's cervical region. Depending on the parameters used to characterize this form of goiter, the incidence of retrosternal goiters varies greatly, ranging from 0.2 to 45% of all thyroidectomies [28,29].

The revealing sign in our study was a vertigo and caught. The majority of patients report some kind of pulmonary manifestation linked to the goiter, and symptoms are typically due to the compressive nature of the mass on the surrounding structures [30]. Plunging goiter is usually referred to as enlarged thyroid gland with greater than 50% of its mass below the thoracic inlet. It has a clinical importance because its compressive symptoms may cause diagnostic problems and the selection of surgical approach is sometimes difficult [31]. The first description of retrosternal goiter dates back to 1749 when the term “Retrosternal goiter” was used to qualify an extension of the thyroid gland below the thoracic inlet [32]. Plunging goiter represents a challenging procedure even for highly experienced surgeons, with an increased rate of some classical thyroid surgery complications. and higher risk of postoperative morbidity is variously reported in the literature, mainly represented by postoperative hypoparathyroidism and recurrent laryngeal nerve injury [33].

A plunging goiter is any goiter whose lower limit is not perceptible in the operative position. The principal risk are compression of the esophagus, subclavian arteries, and trachea with immediate respiratory distress, putting the patient's prognosis at risk [34]. Clinical situations of compression of the aerodigestive axis such as dyspnea, anatomical conditions of neighboring organs, topography, volume and type of goiter are factors that explain the variety of circumstances in which thoracic goiter is discovered. Acute respiratory distress syndrome, cough, dysphagia, and dysphonia [35]. An old goiter with symptoms of mediastinal compression may develop into a plunging goiter, which develops distal to the cervicothoracic border and descends approximately into the thoracic cavity [36]. In the present study; the symptom of compression was cough in left lateral decubitus which persisted for one month.

### Imaging of Plunging Goiter

In this study, half of the goiter volume extended beyond the upper

margin of the sternum, which justified its mediastinal position. Additional definitions can be found in the literature: goiter when the goiter exceeds the height of T4 on a chest X-ray, when the goiter contacts the aortic arch, or when more than 50% of its mass is situated beneath the upper margin of the sternum [37]. The multinodular character could also explain the size of the goiter and its compressive character.

A public health issue is nodular goiter. It can actually progress to a compressive and diving multi-nodular goiter in 5-10% of patients, which is an asphyxia-related emergency [37,38].

And the patient showed no cardiovascular signs or thyrotoxicosis. Cardiovascular signs and symptoms, such as palpitations, atrial fibrillation, and other tachyarrhythmias, are more common in toxic multinodular goiter than in nontoxic multinodular goiter [39]. By chance, we requested a chest X-ray which was quickly accessible in our practice context which revealed the tracheal deviation to the right side (Figure 2).

The most economical test that is crucial for identifying plunging goiters, a straightforward mediastinal enlargement, or an air axis displacement is a standard chest X-ray [40]. Additionally, a bilateral diving goiter must be suspected if there is mediastinal enlargement without tracheal displacement and, a fortiori, if the trachea is parietal [41].

Homogeneous mediastinal opacity was included between the first and fourth thoracic vertebrae.

The diagnosis of mediastinal goiter can be confirmed by a standard chest X-ray [6,41]. In 1957, Lindskog and Goldenberg already proposed that a goiter was radiographically cervicothoracic if it extended beyond the level of the fourth thoracic vertebra's transverse process [42]. In our study, chest X-rays allowed us to note two indirect signs frequently found in this pathology: a widening of the upper mediastinum and a tracheal deviation (Figure 2). This led to request other indicated imaging [42].

We realised MRI which located the mediastinal thyroid mass originating from the left lobe of the thyroid; the right lobe was not visible (Figure 3). In order to rule out a possible non-thyroid tumor; given that the initial clinical context was not a priori in favor of a goiter. For a better assessment of anatomical relationships and confirmation of compressive nature, a cervicothoracic CT scan is the appropriate imaging modality [8]. In addition to determining the degree of compression, it can also be used to visualize the mediastinal extension of the goiter. But MRI can also be requested [6]. The relationships of the goiter are better studied by magnetic resonance imaging (Figure 3) (Figure 4). It allows in the frontal plane to visualize the relationships with the brachiocephalic trunk, the subclavian artery and the internal carotids as well as the relationships of the inferior extensions with the aortic arch [40,41,43].

A thyroid ultrasound and cervical Doppler ultrasound had objectified: a heterogeneous left uni-lobar thyroid mass, without visible inferior delimitation, predominantly isoechoic, with a non-visible inferior pole, with nodular portions of 50 mm and cystic portions measuring 52x47x4 mm or 76 ml with regular contours, with vascular corbeling on color Doppler, classified EUTIRADS 3.

Cervical ultrasound allows the suspicion of the plunging nature of the goiter when the lower limits are not found. It does not allow the evaluation of the thoracic extensions [44].

Plunging goiters are quite common; despite their specific characteristics, our study shows that the exclusive cervical approach is sufficient in the vast majority of cases and that the plunging nature of the goiter does not have a significant impact on postoperative complications.

## Surgery of Plunging Goiter

There is a close correlation between the frequency of cervical goiters and that of plunging goiters; consequently, the latter are very common in goiter-endemic areas [45].

To have easy access to the mass which was not accessible enough by cervical route; we had to make an incision about two finger widths above the sternal manubrium (Figure 6). Plunging goiter is any goiter not located in the cervical region in the operative position and having an extension less than two finger widths below the sternal manubrium, requiring special extraction maneuvers [40].

The cervical approach is suitable for goiter removal in more than 95% of cases. The common definition of Merlier and Eschapasse in 1972 which sets the limit at 2 finger widths below the sternal manubrium making the lower pole of the thyroid gland non-palpable in the surgical position or during swallowing efforts allows us to suggest the diagnosis of plunging goiter [42].

When extirpation of the mass via a cervical approach is not possible, a total thyroidectomy is performed using a combined cervical/sternotomy approach [29]. Anterolateral sternotomy or thoracotomy are only necessary in certain cases, to avoid laborious and brutal maneuvers, sources of operative or postoperative complications [41].

We limited ourselves to the cervicotomy; surely facilitated by the presence of only the thyroid lobe which left enough space to detach (Figure 5) (Figure 7).

Due to the risk of compressive complications, malignancy, and even sudden death, surgical excision is the treatment of choice, even in the absence of clinical signs [41,42]. Surgical indication is clear in plunging goiters given the risk of life-threatening acute respiratory distress, especially since the risk of cancer is difficult to rule out by fine needle aspiration biopsy [7,40].

In the present study, the patient, although 72 years old, did not have any comorbidity that could contraindicate emergency surgery.

This was a good clinical advantage from an anesthetic and surgical point of view. In the absence of absolute medical contraindication, the authors are unanimous in favor of surgical management even in asymptomatic patients [42]. To maximize the surgical safety of our patient, the surgical team consisted of an anesthesiologist, ENT surgeon and cardiothoracic surgeon.

The management of a compressive and plunging multinodular goiter is multidisciplinary by an experienced operating team including resuscitation specialists, ENT specialists and thoracic surgeons [6,39]. The surgical indication for plunging goiter is essential, because due to its volume, it can suddenly reveal itself through respiratory distress, dysphagia or signs of vascular compression due to sudden growth during intragoitrous hemorrhage or during carcinological degeneration [46].

The compressive and deviation of the trachea was worrying, but the intubation procedure was carried out calmly without incident. Tracheal compression by the thyroid mass may result in tracheal deviation, or not. In these cases, induction of general anesthesia can be risky, as it can cause airway obstruction, making intubation or mask ventilation nearly impossible, resulting in shortness of breath. Furthermore, the pressure exerted by the large thyroid nodule on the trachea can cause the tracheal wall to become soft, leading to airway collapse [47]. Preoperative abnormality detection and determination of the appropriate surgical strategy are essential to ensure a safe surgical procedure and avoid any potential complications [9]. The dissection of the infrahyoid muscles was efficient and the sternocleidomastoids were just separated from the thyroid gland, allowing good visibility (Figure 5) (Figure 6). The exclusive cervical approach by a wide cervicotomy including a section of the subhyoid muscles, or even of the anterior head of the sternocleidomastoid, is chosen as the first option. It proves sufficient in the majority of cases [42,48]. Complete dissection of the cervical part with first ligation of the superior pedicle before extraction of the thoracic component improves its mobilization and facilitates its ascension. We performed a dissection of the recurrent nerve from its entry into the larynx and released the thyrotracheal ligaments. However, a sternotomy or thoracotomy associated with a cervicotomy only seems indicated after failure of an attempt at cervical extraction [40,41,42].

Morbidity of diving goiter surgery varies in the literature from 4 to 12% including recurrent nerve injury, hypoparathyroidism and respiratory complications related to compressive hematoma or tracheomalacia which represents a rare complication [48]. In our case, we had no incidents during the surgery and the immediate postoperative course was straight forward and the long-term outcome was favorable (Figure 8).

## Goiter and BPPV

The first theory of BPPV suggests that the attachment of basophilic particles to the cupula of the posterior semicircular canal makes it heavy and cannot return to a neutral state during head movements. The second theory states that the seals existing in the semicircular canaliculi float freely and are subject to gravity, which, moving under its influence, also causes, by inertia, changes in the endolymph, responsible for a deviation of the cupula [52,53].

A detailed review of the published literature failed to show any case of thyroid mass presenting as positional vertigo. the first reported case in the literature showing thyroid mass as a cause for positional vertigo; reported in USA in 2017 by Sanchez al. [22]. The ancient Greeks presumably understood that a carotid artery compression may alter brain function. Seizures or syncope may result from carotid compression. Possible processes include brain ischemia and carotid sinus hypersensitivity. The vertigo is most likely caused by hypo-perfusion to the flocculonodular lobe that is supplied by the anterior inferior cerebellar artery [49]. Apart from tumors or t, or wallenerberg's syndrome; eagles' syndrome, hyroid otoimmune diseases, many factors of BPPV are mentioned in the literature.

Intra-labrynthine schwannomas can cause positional vertigo without any audiological symptoms, according to a 2015 case report [50]. In our study; the patient had vertigo triggered by turning her head to the left or lying on her left side. Demirtas et al. published a case of Eagle syndrome presenting with positional vertigo when the patient in this report experienced vertigo upon cephalic rotation to the left. His complaints disappeared completely in the neutral position [51].

There are Benign paroxysmal positional vertigo (BPPV) which is a peripheral vertigo, whereas infarction of the lateral part of the medulla oblongata (Wallenerberg syndrome) is a central vertigo [52].

VPPB is one of the most prevalent vestibular disorders, which is estimated to be approximately 10% of the lifetime incidence in the general population [54].

It is in somes cases associated with thyroid disorders such as goiter, hypothyroidism, thyroiditis, and hyperthyroidism [13].

In general, there are 17 potential causative factors for secondary BPPV, including aging, sleep habits, osteoporosis and pathology of the vestibule or semicircular canal, autoimmune disorders, familial or genetic predisposition, and allergy.

A systematic review analyzed the relationship between BPPV and thyroid diseases (goiter, hypothyroidism, hyperthyroidism, thyroiditis) and found a risk of developing BPPV [14]. In this case study, the patient had only one risk factor age and goiter.

Eagle syndrome is a rare association of manifestations due to intermittent compression of adjacent cranial nerves or the internal or common carotid artery or vascular Eagle syndrome (EVS) by an elongated or angulated or calcified styloid process; resulting in symptoms suggestive of a cerebrovascular accident (CVA) [55]. CT and MRI are considered first-line imaging modalities because

they can detect compression, stenosis, occlusion, dissection, or the development of a pseudoaneurysm of the carotid artery, [56]. The MRI performed in this case study did not show any elongation of the styloid process.

A few previous studies have indicated a relationship between thyroid disease and BPPV [57]. Some research suggests that thyroidiens auto-anticorps may induce the accumulation of auto-immun complexes in the internal ear, which may alter endolymphatic flow and result in VPPB [58,59]. Thyroid autoantibody immune complexes can activate vestibular receptors that cause changes in volume or composition of the endolymph of the vestibular labyrinth and induce vertigo, such as BPPV [57,60,61].

We were unable to conduct in-depth research into the immunological exploration of goiter due to lack of financial resources in the patient and the lack of technical facilities. This constitutes a limitation of this study; because it would have allowed us to study in depth the immunological and thyroid factors of BPPV. Wajchenberg et al. categorize thyroid disorders into two groups: those that impact thyroid gland function, where serum thyroid hormone concentrations rise or fall, and those that encourage trophic changes in the organ, which are marked by a diffuse growth of the gland and the formation of one or more nodules [54,62].

One factor contributing to this relationship is research indicating a link between low thyroid hormone levels and cardiovascular system alterations, which may be enough to reduce body blood flow and, in turn, encourage a reduction in inner ear microcirculation, which would account for a higher incidence of BPPV in thyroid disease patients [9,62,63]. This could be a hypothesis in our case study, since we have no information on the exact evolution of the goiter due to its fortuitous discovery. The idea that BPPV and chronic autoimmune thyroiditis (CATT) have a common immunological origin is reinforced by the evidence of a link between the two conditions ($P < 0.05$) [64]. Thyroid Hemiagenesis is not known. Due to concern of other thyroid problems, the majority of instances are detected in patients who are hospitalized for thyroid surgery or thyroid scintigraphy. This case explains why hemigenesis is frequently linked to hypothyroidism, hyperthyroidism, adenoma, multinodular goiter, chronic thyroiditis, and cancer, among other thyroid disorders [65].

In people with BPPV, sleeping patterns may be tightly linked to the side that is impacted. It has been discovered that the ear afflicted by BPPV is consistent with the side that lies on the head *[66,*67]. The patient in this case study seemed to be accustomed to lying on her left side; this would explain why she was not discouraged even when the position triggered dizziness (Figure 6).

During sleep, otoconial material that has been released from the utricle by gravity may fall into the lateral or posterior semicircular canals of the most underlying ear [68,69].

These theories could explain BPPV triggered by the habits of lateral decubitus sleeping positions, reinforced by the effect of gravity induced by the left cervicothoracic mass, which causes the migration of otoliths from the utricle towards the lateral or posterior semicircular canals [17]. Thyroid hemi agenesis is an uncommon presentation that is frequently asymptomatic and detected incidentally when imaging for another condition [70]. Keeping these associations of multinodular goiter with lobular agenesis in mind may contribute to safer surgical procedures and fewer surgery-related complications [9]. This study is the second case since 2017; of positional paroxystic vertigo associated with compressive goiter. The first one was 60year old patient with history of vertiginous episodes when she turns her head to the right sides associated with a large thyroid with suprahyoid extension. The thyroid mass was pressing on the carotid while turning her neck to the right causing vertigo [22].

## Conclusion

Various thyroid disorders could have an impact on BPPV; such as goiter, hypothyroidism; thyroiditis and hyperthyroidism. But the majority of cases of thyroid hemiagenesis are associated with euthyroidism. Compression of a carotid artery by the goiter can induce a modification of cerebral function by cerebral ischemia and hypoperfusion of the flocculonodular lobe supplied by the anterior inferior cerebellar artery, inducing vertigo. BPPV can be triggered by sleeping habits in lateral decubitus positions, reinforced by the effect of gravity induced by the left cervicothoracic mass, which causes the migration of otoliths from the utricle to the lateral or posterior semicircular canals. The incidental discovery of a plunging goiter with right lobo-ithsmic agenesis in a context of BPPV is exceptional. In an adult woman without an apparent cervical mass, symptoms of cough and dizziness in the lateral decubitus position may reveal a compressive unilobed plunging goiter, requiring incidental imaging such as a cervicothoracic radiograph for diagnostic guidance. Compressive plunging goiter appears to be one of the thyroid disorders that has an impact on the occurrence of BPPV. Multidisciplinary and surgical emergency management offers a good prognosis.

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