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Challenges of Thyroidectomy for Large Goiters: Our Experience in Goiter Endemic Areas of the Democratic Republic of Congo

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Abstract

Background: Large goiters are common in regions where iodine deficiency is endemic. They lead to technical challenges for surgeons performing a Kocher cervicotomy, due to the anticipated difficulties of dissection and the increase of postoperative complications. Focusing on our experience in goiter-endemic areas, we offer tips and techniques to overcome these challenges. **Patients and methods:** This is a prospective study conducted in hospitals across the North Ubangi and South Ubangi provinces of the DRC from July 2023 to October 2025. The study included 104 patients over a two-year period; all the patients underwent a thyroidectomy. The study parameters included age, sex, surgical indications, treatment before surgery, weight of the surgical specimens, and complications. **Results:** The majority of patients (37.5%) fell within the 41 - 50 age groups. Women were most affected by goiter (95.2%), with a sex ratio of 0.04. Total thyroidectomy was the most frequently performed procedure (68.3%) for large multinodular goiters. A positive correlation was found between the duration and volume of the goiter ($r = 0.234$; $p = 0.042$). The range of 501 - 600 g was the most represented (60%). The mean weight of the thyroid gland postoperatively was 550 ± 50 g. The largest goiter in the series weighed 980 g and spent 42 years. The majority of large goiters (83.7%) were operated on using a cervicotomy technique at the junction of the lower and middle thirds, combined with a cruciform aponeurotomy. The conversion rate for Kocher cervicotomy was 9.6%. More than 80% of patients had sought indigenous treatment prior to surgery. Most complications were minor. We observed 4 cases of acute hemorrhage and 2 of them (1.9%) required blood transfusion. 3 cases (2.8%) of transient recurrent laryngeal nerve paralysis, 3 cases of hypocalcemia (2.8%) and 1 death (0.9%). **Conclusion:** Large goiters are

common in regions with endemic iodine deficiency and cause technical challenges for surgeons due to the anticipated difficulty of dissection and the increase of surgical complications. A cervicotomy performed at the junction of the middle and lower thirds, combined with a cruciform aponeurotomy provides excellent exposure and facilitates dissection, thereby reducing both perioperative and long-term postoperative complications.

Keywords

Large Goiter, Thyroidectomy, Cervicotomy, Cruciform Aponeurotomy

1. Introduction

Thyroidectomy is the partial or total surgical removal of the thyroid gland. A large goiter is defined as having a volume exceeding 100 grams (g). Normal thyroid volume is difficult to determine and varies by region and local iodine status. Until 1950, a normal thyroid was estimated between 20 and 25 g, with an upper limit of 35 g. More recently, studies conducted in countries with sufficient iodine intake have estimated the normal thyroid weight to be 10 g, with an upper limit of 20 g [1] [2].

Large goiters are common in regions where iodine deficiency is endemic. They cause a challenge for surgeons due to the anticipated risk of difficult dissection and the increase of surgical complications. Similarly, they are a source of concern for anesthesiologists due to anticipated intubation difficulties and the risk of post-thyroidectomy tracheomalacia. In this study, we aimed to present our experience in managing large goiters, describing our tips and techniques for thyroidectomy.

Due to their prevalence and potential complications, thyroid disorders constitute a significant global public health issue. The prevalence of goiters, nodules, and thyroid cancers continues to rise, particularly in developing countries where iodine deficiency disorders persist [3]. A large goiter (marked thyroid enlargement) carries the risk of compressing the aero digestive tract (causing dyspnea and dysphagia) and the laryngeal nerves (causing dysphonia). Non-toxic goiters often progress to hyperthyroidism [4]. Multinodular goiter represents the advanced stage of an untreated goiter; it is characterized by nodular heterogeneity resulting from the formation of new follicles and alterations of the vascular network, leading to hyper vascular goiters that are prone to hemorrhage.

In the Democratic Republic of the Congo (DRC), thyroid disorders remain common related to iodine deficiency; despite recent efforts toward national iodine supplementation. The gradual development of endocrine surgery services in hospitals, particularly in urban areas, has led to significant improvements in the surgical management and follow-up of patients with thyroid disorders. However, such specialized care is virtually non-existent in rural areas and in most provinces of the DRC [5] [6].

The surgical technique for thyroidectomy is well standardized. A distinction is made between the conventional procedure used for the removal of large goiters and the video-assisted technique employed for the removal of small multinodular goiters, which offers an aesthetic advantage (a 2 to 2.5 cm scar) [7]. The conventional technique, which is the most widely used in developing countries, faces three major challenges when dealing with large goiters:

- Difficult access to the superior pole of the thyroid for the ligation and division of the superior thyroid arteries;
- Due to poor exposure, enucleation of large lateral lobes is difficult or even impossible, as they are buried beneath the superficial cervical fascia and the sternocleidomastoid muscles. Consequently, the tearing of vessels that have not been identified and ligated during operative maneuvers leads to massive hemorrhage, endangering the patient's life.
- Dissection difficulties resulting from cutaneous-aponeurotic fibrosis associated with long-standing goiters and indigenous treatments (scarification, massage, application of hot poultices, etc.).

Due to these technical challenges, we addressed the following question:

- What tips and techniques are best suited for large goiters in the endemic areas?

2. Materials and Methods

2.1. Study Framework

Nord-Ubangi and Sud-Ubangi are two of the 26 provinces of the Democratic Republic of Congo (DRC). They had respectively the estimated populations of 1.5 million inhabitants and 4.1 million inhabitants. As materials we used Ultra sound type Sun bright for thyroid sonography, Fine Care Fluorescent Nanospheres in NIR window for biological test of thyroids hormones, Portable electronic scale for weighing specimens.

2.2. Type and Period of the Study

This is a prospective study conducted in 3 hospitals of Nord-Ubangi (Gbadolite, Yakoma, and Karawa) and 1 hospital in the province of Sud-Ubangi (Gemena) in the Democratic Republic of Congo between July 2023 and October 2025.

2.3. Inclusion and Exclusion Criteria

2.3.1. Inclusion Criteria

This study focused on all patients aged from 20 up to 80 years, admitted to our medical consultation and operated for goiters in the four hospitals of Nord-Ubangi and Sud-Ubangi in RD Congo.

2.3.2. Non-Inclusion Criteria

We did not include in this study:

- Any patient that thyroid ultrasonography was not performed before surgery,
- All the patients that postoperative specimens were not weighed,

- Any patient with non-operated goiter,
- Any patient operated on but whose postoperative follow-up was not carried out by our team,
- Any patient under the age of 20 who has undergone neck surgery.

2.4. Sampling

All the patients were selected after the diagnosis of thyroid mass (goiter or suspicion of thyroid cancer), ultrasonography of the neck using linear probe 7.5 MHz; thyroid hormones dosage (T3, T4, TSH) and thyroid specimen were weighed after thyroidectomy.

The study included 104 patients over a two-year period with an annual frequency of 52 cases; all patients underwent a thyroidectomy. Patients with hypothyroidism or hyperthyroidism were rendered euthyroid through treatment with levothyroxine and propylthiouracil, respectively.

2.5. Study Variables

The study variables were age, sex, surgical indications, treatment prior surgery, weight of the surgical specimens, and complications.

2.6. Data Processing and Analysis

We used Excel 2016 software and IBM SPSS 21 (Statistical Package for social sciences) version 21.0 for processing and data analysis. Different statistical tests were averaging, standard deviation, Chi-square test, Pearson Correlation (r) and the T-Student.

2.7. Surgical Procedures

Surgical approach was selected according to the ultrasound volume of the goiter prior the surgery: any goiter < 100 ml was operated on Kocher procedure (low cervicotomy). Goiters > 100 ml were operated on incision at the junction of the middle and lower thirds of the mass' length and cruciform aponeurotomy (our tips and techniques).

2.8. Operational Definitions

1) The Conventional Technique (Kocher Incision)

The incision is performed two finger-breadths above the suprasternal notch, followed by a longitudinal aponeurotomy with midline opening and retraction of the infrahyoid muscles. Steps include nerve monitoring of the recurrent laryngeal nerves, ligation and division of the superior and inferior thyroid arteries, enucleation of the mass and subsequent hemostasis.

2) Our tips and techniques at the junction of the middle and lower thirds of the mass' length and cruciform aponeurotomy (Demongawi's procedure).

- Measurement of the length of the upper and lower poles;
- Marking the transverse incision between the lower and middle thirds of the

mass using a skin marker;
- Dissection of the skin down to the superficial cervical fascia;
- Cruciform incision of the superficial cervical fascia;
- Transverse dissection of the platysma and infrahyoid muscles;
- Dissection of the thyroid attachment membranes;
- Ligation and division of the superior thyroid arteries, followed by the inferior thyroid arteries;
- Localization of the laryngeal nerves;
- Enucleation of the mass followed by division of Gruber's ligament;
- Achievement of hemostasis;
- Placement of a flat drain;
- Resection of excess skin (common in cases of large goiters);
- Closure of the cervicotomy in three layers and application of a sterile dressing.

3) Surgical conversion

Surgical conversion refers to an unplanned switch during thyroidectomy from Kocher cervicotomy approach to the lower 1/3 cervicotomy associated with cruciform aponeurotomy. The intraoperative findings such as difficulties of viewing the two poles of thyroid gland, fibrosis of anatomical structures due to indigenous treatment, large goiters with underestimated volume by preoperative ultrasonography, and intraoperative suspicion of thyroid cancer with necessity of lymphadenectomy.

2.9. Postoperative Follow-Up

Patients' follow-up was scheduled at two weeks, 1 month, 3 months, 6 months and 12 months postoperatively. Laboratory tests were performed at every medical visit: hemoglobin, T3, T4, TSH, serum electrolytes, clinical and voice evaluation.

3. Results

3.1. Patients' Age-Groups of the Study

The mean age of our patients was 35 ± 6 years; the majority (37.5%) fell within the 41 - 50 age-groups, with a range of 20 to 80 years (see Table 1).

Table 1. Patient age groups.

Age groups (year)	Number (n = 104)	%
20 - 30	10	9.6
31 - 40	15	14.4
41 - 50	39	37.5
51 - 60	26	25
61 - 70	9	8.7
71 - 80	5	4.8
	104	**100**

3.2. Distribution of the Patients According to the Sex

The female population was the most affected by goiter (95.2%), representing a sex ratio of 0.04 (see Table 2).

Table 2. Distribution of patients by sex.

Sex	Number (n = 104)	%
Female	99	95.2
Male	5	4.8
	104	100

3.3. Distribution of Patients According to Indications for Thyroidectomy

Total thyroidectomy was the most frequently performed procedure (68.3%) for large multinodular goiters (see Table 3).

Table 3. Distribution of patients according to indications for thyroidectomy.

Procedures	Indications	Number (n = 104)	%
Total thyroidectomy	Large multinodular goiter	71	68.3
	Plunging goiter	6	5.8
	Graves' disease	5	4.8
	suspicious nodule for malignancy	3	2.8
	strumitis	2	2
Right lobectomy	Right unilobar goiter	5	4.8
Left lobectomy	Left unilobar goiter	8	7.7
Isthmusectomy	Isthmic nodule	4	3.8
		104	100

3.4. Distribution of Thyroid Gland Related to the Volume of Thyroid Specimens

The range of 501 - 600 g was the most represented (60%). The mean weight of the thyroid gland postoperatively was 550 ± 50 g (see Table 4).

3.5. Comparison between Ultrasonographic Volume and the Specimen Volume of the Thyroid

The ultrasonographic and the specimen mean volume of the thyroid were respectively 290 ml and 348 ml. The variation P (%) from the ultrasonographic volume and the specimen volume of the thyroid ranged between 10% - 30% (see Table 5).

Table 4. Mean volume of thyroid specimens.

Volume (ml)	Nombre (n = 104)	%
100 - 200	4	3.8
201 - 300	2	1.9
301 -400	4	3.8
401 - 500	10	9.6
501 - 600	62	59.9
601 -700	12	11.5
701 - 800	5	4.8
801 - 900	3	2.8
901 - 1000	2	1.9
	104	**100**

Table 5. Comparison between ultrasonographic volume and specimens' volume of the thyroid.

Groups	Ultrasonography Mean volume (ml)	Specimen Mean volume (ml)	P (%)
100 - 200 (n = 4)	142	156	10
201 - 300 (n = 2)	260	312	20
301 -400 (n = 4)	154	193	25
401 - 500 (n = 10)	145	186	28
501 - 600 (n = 62)	460	605	30
601 - 700 (n = 12)	350	400	14
701 - 800 (n = 5)	420	525	25
801 - 900 (n = 3)	310	340	10
901 - 1000 (n = 2)	365	412	12

There is no linear correlation between the ultrasound volume and the volume of the surgical specimen for goiters > 200 ml (Figure 1).

3.6. Comparison between the Specimen Volume of the Thyroid and the Goiter Duration

The correlation coefficient (r = 1). There is a perfect linear correlation between thyroid volume and the duration of the goiter. The two variables change in perfect proportionality (Table 6).

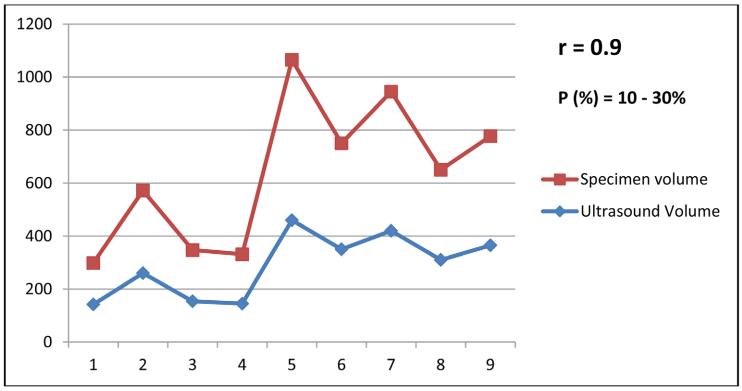

Figure 1. Comparison between ultrasonic volume and surgical specimen volume of the thyroid (ml).

Table 6. Comparison between the specimen volume of the thyroid and the goiter duration.

Groups	Ultrasonography Mean volume (ml)	Specimen Mean volume (ml)	Goiter Mean duration (Years)	Correlation coeff. (r)
100 - 200	142	156	5	
201 - 300	260	312	8	
301 -400	154	193	16	
401 - 500	145	186	18	**r = 1**
501 - 600	460	605	22	
601 - 700	350	400	25	
701 - 800	420	525	28	
801 - 900	310	340	32	
901 -1000	365	412	42	

There is a positive correlation (r = 1) between the volume of the thyroid and the duration of goiter (see Figure 2).

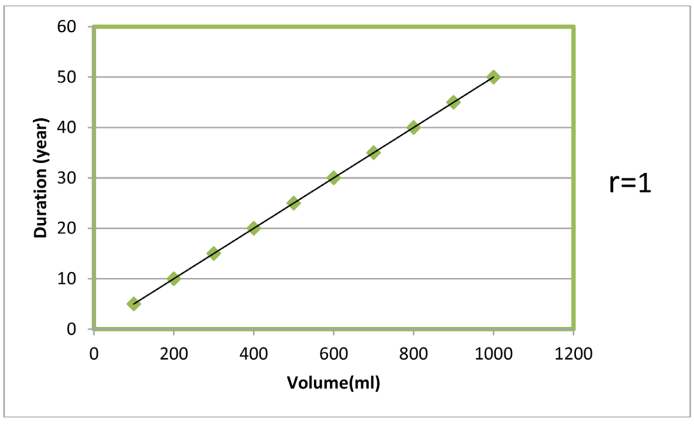

Figure 2. Correlation between the volume of thyroid specimen and the duration of goiter.

3.7. Distribution of Patients Related to Treatment Received Prior to Thyroidectomy

About 93% of patients used indigenous treatment before thyroidectomy and only 10.5 used medical treatment by levothyroxine and strumazol (see Table 7).

Table 7. Treatment prior to thyroidectomy.

Types of treatment	Number (n = 104)	%
Levothyroxine	7	6.7
Trumazol	4	3.8
Ointment	73	70.2
Thyroid massage	12	11.6
Scarification + ointment	8	7.7
	104	100

3.8. Distribution of Patients According to Surgical Procedures

The majority of large goiters (83.7%) were operated on using the cervicotomy technique at the junction of the lower and middle thirds, combined with a cruciform aponeurotomy (Figure 3). The conversion rate for conventional thyroidectomy was 9.6% (see Table 8).

Table 8. Types of surgical procedures.

Surgical techniques	Number (n = 104)	%
Conventional technique (Kocher cervicotomy)	7	6.7
Converted Kocher cervicotomy	10	9.6
Our tips and techniques (Cervicotomy at the junction of the lower and middle thirds of the mass, combined with a cruciate aponeurotomy)	87	83.7
	104	**100**

3.9. Distribution of Patients Related to Peroperative and Postoperative Complications According to Clavien-Dindo

Most complications were minor. We identified four cases of acute hemorrhage and two of the cases (1.9%) required a blood transfusion. There was 1 death (0.9%) (see Table 9).

Table 9. Classification of surgical complications according to Clavien-Dindo.

Complications	Number	Classification				
		1	2	3	4	5
Acute hemorrhage	4		2 (3.8%)			

Continued

Recurrent laryngeal nerve paralysis	00		
Dysphonia	2	1 (0.9%)	
Hypocalcemia	3	3 (2.8%)	
Hypothyroidism	6	6 (5.7%)	
Infection	00		
Death	1		1 (0.9%)

Figure 3. Images before and after total thyroidectomy for multinodular goiter.

4. Discussion

We performed 104 thyroidectomies over a two-year period, representing an average of 52 cases per year.

The mean age of the patients was 35 ± 6 years. The majority of patients (37.5%) fell within the 40 - 50 age groups, with a peak between 31 and 60 years and a range of 20 to 80 years. Patient age alone is generally not an absolute contraindication for thyroidectomy. Surgeons frequently perform the procedure safely on both paediatric and geriatric populations. However, age often influences the indications for surgery and may present specific relative contraindications or elevated risk factors [8].

The female population was the most affected by goiter (95.2%). The predominance of thyroid disease in women has been reported by other authors [9]-[11]. This clinical situation is linked to the presence of estrogen receptors on thyroid cells which promote the development of goiter during hormonal surges (puberty, pregnancy, and menopause) as well as to iodine deficiency, as iodine requirements increase during pregnancy.

Total thyroidectomy was the most frequently performed procedure (68.3%) for large multinodular goiters, followed by cases of simple goiter (13 patients, 12.5%) and thyroid cancer (3 patients, 2.8%). These indications are consistent with most recent literature [12]-[14]. The majority of large goiters (83.7%) were operated on using the cervicotomy technique at the junction of the lower and middle thirds, combined with a cruciform aponeurotomy. The conversion rate for conventional thyroidectomy was 9.6%. Total thyroidectomy offers the advantage of providing

radical, definitive treatment for the goiter, with no risk of recurrence. In our context, it is justified by the unavailability of intraoperative biopsy, the late management of thyroid diseases, and the limited use of minimally invasive techniques

We found a positive correlation between the duration and volume of the goiter ($r = 1$; $p = 0.042$). The largest volume of goiter in the series was 980 g, associated with duration of 42 years at a patient of 73 years old. The mean duration of goiters was 15 years. There is a linear positive correlation between the duration of goiters and thyroid volume, with the increasing of 4.5% per year [14] [15]. This gradual increase, due to the persistence of growth factors, raises the risk of compressive symptoms and nodular transformation over time.

About 93% of patients underwent indigenous treatment before surgery (thyroid massage, poultices, and scarification). These practices, common in areas of endemic goiter in the DR Congo, trigger an inflammatory reaction leading to fibrosis of the cutaneous, fascial, and thyroid structures, thereby increasing the difficulty of dissection.

The majority of large goiters (83.7%) were operated on using a cervicotomy procedure performed at the junction of the lower and middle thirds, combined with a cruciform aponeurotomy. The conversion rate for Kocher cervicotomy was 9.6%. Our results differ from those of Gardner (Edinburgh, 1995), who performed 474 thyroidectomies for large goiters, including 47 total thyroidectomies (10%) [16] [17]. This difference is likely attributable to the difficulty of performing a total thyroidectomy using the conventional procedure (Kocher's thyroidectomy) in cases of large goiters.

Most complications were minor. We observed 4 cases (3.8%) of acute hemorrhage intraoperatively and 2 of them (0.9%) required blood transfusion, there were no cases of reoperation. There were 2 cases (0.9%) of dysphonia; no transient recurrent laryngeal nerve palsy was observed. 3 cases of hypocalcemia (2.8%) and 1 death (0.9%). This result differs from that of CATHY study [18], which reported 8% of recurrent laryngeal nerve palsy. We believe this discrepancy may be due to the fact that we relied solely on voice assessment rather than nerve monitoring to detect recurrent laryngeal nerve palsy. The same study indicates a relationship between surgeon experience and the rate of postoperative complications.

5. Conclusion

Large goiters are common in regions with endemic iodine deficiency and cause technical challenges for surgeons due to the anticipated difficulty of dissection and the increase of surgical complications. A cervicotomy performed at the junction of the middle and lower thirds, combined with a cruciform aponeurotomy and transverse section of the infrahyoid muscles, provides excellent exposure and facilitates dissection, thereby reducing both perioperative and long-term postoperative complications.

Units

Age of the patients (year), Indications of thyroidectomy (%), weight of specimens

(g), duration of goiter (year), treatment prior to thyroidectomy (%), Surgical procedures (%), Surgical complications (%).

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Author Contributions

DKR developed the study protocol, collected, analyzed the data and wrote the first draft of manuscript. MMD reviewed Methods and Materials, made critical revision of the manuscript according to scientific point of view. LJ organized the study framework and availability of surgical instruments.

Data Availability

The datasets used and analyzed during the current study are available from the corresponding author and can be verified on request.

Ethical Considerations

We obtained approval from the Medical Ethics of Provincial Health administration N˚221/CAB/MINIPRO/SP-TPS-FP/N-UB/DBC/2022, and the authorization of Nord-Ubangi and Sud-Ubangi Provincial Divisions of Health.

Conflicts of Interest

The authors declare that they have no conflict of interest in relation to this article.

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Abbreviations and Acronyms

DRC: Democratic Republic of Congo, WHO: World Health Organization, HZ: Health Zone, T4: Tetra-iodo-thyroxine, T3: Tri-iodo-thyronine.