

Research Article

Ultrasound-Guided Assessment and Management of Seroma after Total Thyroidectomy: A Prospective Study

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ABSTRACT

Background: A complication that is known after total thyroidectomy is seroma, which is a collection of serous fluid in the surgical dead space after the removal of the drain. To avoid wound-related morbidity, early detection and minimally invasive management are key. In this clinical scenario, ultrasound has proven to be a very accurate, non-invasive diagnostic and therapeutic tool.

Objective: To assess the accuracy of ultrasound for diagnosing postoperative seroma and the effectiveness and safety of ultrasound-guided aspiration for seroma management in patients undergoing total thyroidectomy.

Methods: The study was a prospective study that was carried out in Al-Tibri Medical College and Hospital from March 2025 to August 2025. A total of 50 consecutive patients underwent total thyroidectomy for multinodular goiter. A sonogram was performed on days 3 to 4 after the removal of the drain to evaluate for the presence of seroma. Ultrasound-guided aspiration was used for the treatment of confirmed seroma cases.

Results: Seroma was detected in 15 (30%) patients. All cases were 100% diagnosed using ultrasound. Up to 20 ml per aspiration was enough for 10 (66.7%) patients. Of the five (33.3%) patients who did need serial aspirations, adjunct pressure dressing was used. There were no re-explorations, wound infections, or hospital re-admissions among all patients.

Conclusion: Ultrasound can be a reliable, real-time diagnostic tool for the detection and quantification of postoperative seroma. The ultrasound-guided aspiration is a safe, less invasive, and effective management tool and avoids surgical re-intervention.

Keywords: Seroma, Total Thyroidectomy, Ultrasound, Aspiration, Postoperative Complication, Neck Fluid Collection.

INTRODUCTION

Total thyroidectomy is one of the most common surgical procedures in the management of thyroid diseases such as hyperthyroidism, thyroid cancer, and multinodular goiter. Although the surgical techniques and post-surgical management have improved significantly, post-surgical complications remain a challenge. Seroma is a known complication after thyroid surgery in which serous fluid collects in the dead space formed as a result of the surgery (1). Though it is a minor complication, if not managed properly or delayed in management, it can make the

patient more vulnerable to a wound infection, prolong hospital stay and result in patient dissatisfaction. Thus, understanding the risk factors, diagnostic tools, and treatment options for seroma are crucial to achieving the best possible surgical results. The applications of ultrasound in thyroid disease have grown beyond its diagnostic image to therapeutic applications, as ultrasound-guided procedures are taking an increasing part in the surgical practice of today.

Management of benign thyroid disease has changed significantly in the last ten years and is becoming more and more a minimally

invasive approach. Guidelines for ultrasound-guided thermal ablation have defined the place of ultrasound as a diagnostic and therapeutic tool in the management of thyroid diseases, proving the accuracy and versatility of the modality (2). Although surgical techniques for the thyroid gland have changed and improved over the years, the peri-surgical management of thyroid disorders is also becoming more important, and risk stratification and peri-surgical management strategies play a pivotal role in minimizing morbidity (3). Postoperative complications are chyle fistula and seroma, which have been managed minimally invasively and have been increasingly discussed in the literature, in particular after thyroid surgery and neck surgery (4).

The application of ultrasound guided intervention has been expanded to other sites besides the thyroid. In the treatment of thyroglossal duct cysts, ethanol ablation is a similar treatment to surgery, and ultrasound-guided techniques are effective as first-line treatment options (5). The minimally invasive technique, also guided by ultrasound, has also been shown to be effective in breast surgery for idiopathic granulomatous mastitis, with similar results to surgical ablation (6). Such parallel developments include the use of ultrasound in other surgical procedures and have influenced the use of ultrasound in the management of postoperative complications after thyroid surgery in a significant way.

It is crucial to have accurate imaging during the perioperative period to allow early recognition of thyroid and neck disorders. The Thyroid Imaging Reporting and Data System (TI-RADS) has been validated as a tool to characterize thyroid lesions and to diagnose thyroid disease, emphasizing the need for a standardized reporting of thyroid lesions based on ultrasound in thyroid disease management (7). Neck hematoma is an acute and life threatening complication of thyroidectomy which should be recognized and treated promptly. A large number of management algorithms for post-thyroidectomy neck hematoma have been reported in the literature, and post-operative monitoring of fluid collections in the neck is crucial (8). Although seroma is not as immediately life-threatening as a hematoma, it can be treated as such by its clinical context, it can also be assessed by the same framework. Breast cancer surgery research has greatly advanced the evidence base on the issue of seroma, since this complication is frequently seen and researched in this context. To develop

predictive models of risk factors for seroma after breast surgery, multicentre cohort studies have been conducted, which included the surgical extent, drain management, and patient-related factors (9). There are parallels also in the cervical surgery and such prognostic information is now being utilized in that surgery. There have been studies comparing the safety and effectiveness of thermal ablation to the endoscopic treatment of thyroid nodules, and this is another reason why minimally invasive techniques are crucial to preserve patient quality of life and to prevent reoperation (10).

Technical difficulties of total thyroidectomy have direct implications on rates of postoperative complications. Surgical techniques that focus on preserving the recurrent laryngeal nerve and parathyroid glands have been linked to fewer postoperative complications and better outcomes. Another application of ultrasound in the postoperative monitoring of thyroid disorders is the evaluation of the cervical lymph nodes, by ultrasound guided fine needle aspiration, and standardized reporting systems (12). After total thyroidectomy, functional preservation of the thyroid tissue has been studied by autotransplantation, which presents technical difficulties and is the current practice of thyroid surgery (13).

The learning curve of advanced thyroid surgery techniques like transoral endoscopic thyroidectomy is a good example of the constant evolution of thyroid surgery and the necessity of standardizing training and outcome monitoring (14). The evaluation of the thyroid remnant tissue after thyroid surgery by ultrasonography and radionuclide uptake studies has given objective parameters to assess the completeness of surgery, further highlighting the importance of ultrasonography in thyroid surgical follow-up after the surgery (15). Endoscopic thyroidectomy via the areola approach has been demonstrated to be technically feasible, safe, and effective for early papillary thyroid carcinoma (PTC) (16) and is currently gaining popularity along with the many minimally invasive surgical options currently available for thyroid surgery. There are also new combinations of single incision surgery and central neck dissection, with new surgical tools and early outcomes indicating the potential for the use of these techniques in the treatment of bilateral thyroid cancers (17).

In the backdrop of changing surgical techniques in thyroid surgery and growing

applications of ultrasound, a dedicated study of prospective evaluation of seroma formation after total thyroidectomy still needs to be studied in the Pakistani context. The aim of the present study was to systematically review the postoperative seroma rate after total thyroidectomy in euthyroid patients with multinodular goiter, assess the accuracy of postoperative ultrasound for identification of fluid collections in the neck, and evaluate the clinical outcomes of ultrasound-guided aspiration as a minimally invasive treatment.

Objective

To assess the contribution and guided aspiration management of seroma after total thyroidectomy, and to find the incidence and clinical outcome of seroma after surgery for multinodular goiter in euthyroid patients in a tertiary care center in Pakistan.

MATERIALS AND METHODS

Study Design: This was a prospective observational study.

Study Setting: The study was conducted in the Department of ENT, Al-Tibri Medical College and Hospital, Pakistan.

Duration of Study: March 2025 to August 2025.

Inclusion Criteria

Patients aged 18 years and above who underwent total thyroidectomy for benign multinodular goiter during the study period were included in the study. The patients should have been biochemically euthyroid at the time of surgery, and this was confirmed by the preoperative thyroid function tests. Only patients who gave written informed consent for study participation and who could be followed up on postoperative days 3 and 4 after removal of the drain were included. Patients who had primary total thyroidectomy as the initial

surgery and had no previous surgery on the same side of the neck were recruited.

Exclusion Criteria

Patients who were suspected of having thyroid malignancy preoperatively or those who had suspicious thyroid malignancy findings intraoperatively were excluded. Patients who had previously undergone neck surgery, had coagulopathy, or were currently infected with a systemic infection were excluded. Patients who had incomplete postoperative follow-up or who refused to participate or withdrew consent were also excluded. Those who were pregnant and patients with known hypersensitivity to ultrasound gel or local anesthetic agents used during aspiration were excluded.

METHODS

After institutional ethical approval, 50 consecutive patients who met the inclusion criteria were recruited by non-probability consecutive sampling. All patients were treated with the conventional total thyroidectomy surgery by an experienced surgeon. A surgical drain was inserted in all patients and removed on postoperative day 2. Cervical ultrasound was performed postoperatively on days 3 and 4 after the removal of the drain to check for residual fluid in the operative bed. If a seroma was diagnosed by ultrasound, it was aspirated under aseptic conditions. The amount of fluid aspirated was noted. Patients who needed more than one aspiration session had serial aspirations and pressure dressing. Data were collected on a structured proforma and analyzed in SPSS version 26.

RESULTS

Fifty patients who had undergone total thyroidectomy were included in this study. Demographic and clinical data of the study population are shown in Table 1.

Table 1. Demographic and Clinical Characteristics of Study Participants (n = 50)

Variable	Frequency (n)	Percentage (%)
Age Group (Years)		
18–30	14	28.0
31–45	22	44.0
46–60	11	22.0
>60	3	6.0
Gender		
Female	35	70.0
Male	15	30.0
Indication for Thyroidectomy		
Multinodular Goitre	50	100.0

Thyroid Status (Euthyroid)	50	100.0
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The study population had a mean age of 38.6 ± 11.4 years. As in the known female predominance of thyroid disease, the majority of participants were female (35, 70.0%). At the time of the operation, all 50 patients were

euthyroid, and the indication for surgery in all cases was multinodular goiter. The incidence and detection parameters of seroma after surgery are summarised in Table 2.

Table 2. Incidence and Ultrasound Detection of Postoperative Seroma (n = 50)

Outcome	Frequency (n)	Percentage (%)
Seroma Detected	15	30.0
No Seroma	35	70.0
Total	50	100.0
Timing of Seroma Detection		
Postoperative Day 3	9	60.0 of seroma cases
Postoperative Day 4	6	40.0 of seroma cases
Ultrasound Detection Accuracy		
Confirmed Seroma on USS	15	100.0
False Positives	0	0.0

After draining, 15 (30.0%) patients were found to have seroma. All 15 diagnoses were confirmed on ultrasound, with 100% diagnostic accuracy. Most seroma patients (nine, 60.0%) were diagnosed on postoperative day 3, and the remaining patients (six, 40.0%) were

diagnosed on postoperative day 4. In the other 35 (70.0%) patients, no seroma was found. The distribution of the volume of seroma and the management strategy used are listed in Table 3.

Table 3. Seroma Volume and Management Strategy (n = 15)

Management Category	Fluid Volume	n	%
Single USS-guided aspiration	≤20 ml	10	66.7
Serial aspirations + pressure dressing	>20–30 ml	4	26.7
Serial aspirations (>30 ml)	>30 ml	1	6.6
Total seroma cases	—	15	100.0

Of the 15 patients who were diagnosed with seroma, 10 (66.7%) had a fluid volume of 20 ml or less and were successfully treated with one ultrasound-guided aspiration procedure. The volume in 4 patients (26.7%) was between 20ml and 30ml and required multiple aspirations and pressure dressings. In 1 patient

(6.6%), there was a large volume of fluid (more than 30 ml), which had to be aspirated several times before resolution. The average seroma fluid aspirated in all patients was 22.3 ± 8.1 ml. The seroma and non-seroma groups have comparable clinical results, as shown in Table 4.

Table 4. Clinical Outcomes in Seroma and Non-Seroma Groups

Outcome Parameter	Seroma Group (n=15)	No Seroma Group (n=35)
Mean fluid volume aspirated (ml)	22.3 ± 8.1	—
Resolution after single aspiration	10 (66.7%)	N/A
Required serial aspirations	5 (33.3%)	N/A
Wound infection	0 (0%)	0 (0%)
Re-exploration required	0 (0%)	0 (0%)
Hospital readmission	0 (0%)	0 (0%)
Patient satisfaction (Good/Excellent)	15 (100%)	35 (100%)

All patients in both groups had no wound infection, surgical re-exploration, or hospital readmission. Patients who had aspiration under ultrasound guidance reported good

improvement of symptoms after aspiration. The distribution of seroma outcome in the study population is shown in Figure 1.

Figure 1. Distribution of Seroma Outcomes After Total Thyroidectomy (n=50)

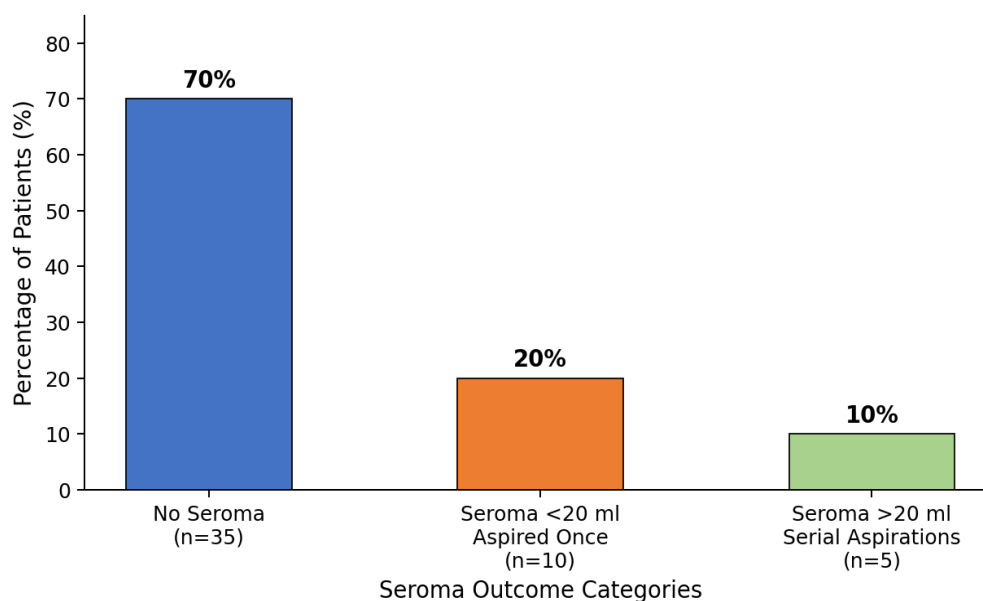


Figure 1. Distribution of seroma outcomes following total thyroidectomy (n = 50).

DISCUSSION

The present prospective study aimed to assess the incidence of postoperative seroma after total thyroidectomy and the usefulness of ultrasound for the diagnosis and treatment of seroma. The incidence of seroma was 30%, which is comparable to the incidence reported in the surgical literature and is a clinically important complication in this surgical setting. The results show that postoperative cervical ultrasound is useful for diagnosis of seroma, and ultrasound-guided aspiration is a minimally invasive treatment without surgical reintervention.

In recent years, the use of ultrasound in thyroid surgery has greatly increased. The ultrasound-assisted procedures have been compared to thyroidectomy and have been demonstrated to be as effective as thyroidectomy in certain patients with benign thyroid nodules, highlighting the versatility of ultrasound as a therapeutic tool (1). The technical requirements and indications for the use of ultrasound-guided ablation have been established in national guidelines, and ultrasound is becoming increasingly important in the management of thyroid disease nowadays (2). These advances make the use of ultrasound in the perioperative management of thyroid surgery a logical next step: when the surgeon can monitor the surgical site during the procedure and act quickly and precisely on complications, the use of ultrasound becomes logical.

Fluids collections in the postoperative period are a known complication of surgery in a variety of surgical specialties. In cases of neck surgery, chyle fistula following lymph node resection has been managed by minimally invasive percutaneous surgery under ultrasound guidance with the reported success of accelerating the resolution and reducing the operative morbidity (4). The principle of ultrasound guided aspiration in the management of seroma is the same, but the clinician is able to directly visualize the fluid collection and determine the position of the needle, thereby avoiding the potential for accidental injury to adjacent structures such as the internal jugular vein, recurrent laryngeal nerve, and the carotid artery. This accuracy is especially important in the postoperative neck situation, where anatomical changes as a result of surgery can make blind aspiration more difficult.

It is a method that is being used in other surgical specialties, and is supported by this experience. Lastly, ethanol ablation of thyroglossal duct cysts under ultrasound guidance has been found to be an effective definitive treatment and cure rates comparable to the Sistrunk procedure (5). Likewise, the efficacy of ultrasound-guided microwave ablation was shown to be comparable to surgical mastectomy in treating idiopathic granulomatous mastitis, and with fewer complications and a faster recovery (6). The results all point to the fact that minimally invasive interventions guided by ultrasound are

a paradigm shift in the management of surgical complications and could be applied to a wide range of clinical situations, such as postoperative seroma after thyroidectomy.

For thyroid surgery, it is essential to have good imaging pre- and post-surgery. The Thyroid Imaging Reporting and Data System (TI-RADS) has been validated as a reliable system to describe thyroid lesions and link the imaging results to the histopathological diagnosis, which enhances the accuracy of diagnosis and facilitates the surgical decision-making (7). Ultrasound can also be used during the postoperative period, but in this case, to obtain an objective and reproducible assessment of the surgical bed. Neck hematoma after thyroidectomy is a condition that can have a clinical appearance similar to the cervical swelling seen with seroma and must be quickly identified and treated. In structured management pathways of post-thyroidectomy neck hematoma, based on imaging assessment, catastrophic airway compromise has been avoided and the need for emergency re-exploration reduced (8). Similar care and attention in detecting and managing seroma can reduce the risk of seroma becoming infected or forming an abscess.

There is a well-established body of literature on the subject of postoperative seroma in breast surgery, which has evolved into a solid evidence base to guide practice in other surgical specialties. Retrospective, dual-center studies have shown clinical and operative factors associated with the development of seroma after breast cancer surgery and could therefore be used to stratify patients for cervical surgery (9). In both settings, there are some common factors that influence the risk for seroma, including surgical dead spaces, surgical dissection, and drain management. The comparison between the two procedures, ablation and endoscopic thyroidectomy, has shown that the minimally invasive procedure is linked to better patient satisfaction outcomes and has clinical significance with regard to the reduction in operative morbidity (10).

The surgical approach is directly and significantly related to the postoperative complications after TT. The medial-to-superior approach has been studied in a number of publications and has resulted in the conclusion that fewer injuries to the recurrent laryngeal nerve and less hypocalcemia and voice change occur (11). These technical advances mean that major complications are less common, but the risk of the development of seroma remains, and

this is mainly due to the inherent dead space formed in the neck after the thyroid tissue has been removed. The other aspect of the postoperative usefulness of ultrasound is the evaluation of the cervical lymph nodes, as described in the Sydney system for reporting neck lymphadenopathy by ultrasound-guided fine-needle aspiration of thyroid surgical patients, which will be described below (12).

Newer developments in thyroid surgery include techniques like thyroid tissue autotransplantation and endoscopic surgery, which further demonstrate the technical diversity of today's thyroid surgery (13). The learning curve of transoral endoscopic thyroidectomy has been described in prospective cohort studies, and it is believed that at least 10 cases per surgeon per year is required to keep the degree of complications within an acceptable range (14). The role of imaging in the post-thyroidectomy remnant assessment using ultrasonography and technetium uptake studies has reinforced the value of imaging in postoperative surveillance for completeness of surgery (15). In selected patients, both of these techniques are demonstrating satisfactory safety and oncologic results, with endoscopic surgery and modified single incision surgery both posting promising results (16, 17). In light of the advances in surgical techniques, the present study focuses on an aspect of postoperative care which may be considered to be relatively simple yet clinically important, namely the early diagnosis and management of seroma by ultrasound, irrespective of the surgical technique utilized.

The findings of the present study have clinical implications in the management of the postoperative course after total thyroidectomy. Considering the high incidence of 30% seroma in this group, postoperative cervical ultrasound should be routinely used as a part of postoperative surveillance, particularly on postoperative day 3 and 4 after drain removal. This study's 100% diagnostic accuracy further supports the use of ultrasound as the imaging modality of choice for assessment of cervical fluid collection. No additional surgical re-intervention was necessary for any case, and all cases were successfully treated with ultrasound guided aspiration (ambulatory or hospital) with a significant reduction in patient morbidity and healthcare resource use.

CONCLUSION

The present prospective study shows that seroma is a clinically relevant complication that

occurs in around 30% of patients after total thyroidectomy for euthyroid multinodular goiter. Postoperative cervical ultrasound was performed on day 3-4 after the drain removal, and all cases were detected with 100% accuracy, making it the modality of choice in the diagnosis of this complication. The aspiration by ultrasound proved to be a safe, minimally invasive, and effective management strategy, with complete resolution being achieved in all patients without re-exploration of the wound, debridement, or hospital readmission. If there was a large amount of seroma (more than 20 ml), repeated aspirations with pressure dressings were necessary but equally successful. The results lend themselves to the addition of routine postoperative ultrasound evaluation and ultrasound-guided aspiration to the standard surgical pathway after total thyroidectomy, which could decrease morbidity, eliminate unnecessary surgical re-intervention, and enhance a patient's surgical care at every stage.

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