ROLE OF CLINICAL PHARMACY INTERVENTIONS AND PATIENT COUNSELLING IN THE MANAGEMENT OF HYPOTHYROIDISM: A FOUR-PATIENT CASE STUDY

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Abstract

Hypothyroidism is a common endocrine disorder that requires lifelong thyroid hormone replacement therapy, regular monitoring, and sustained medication adherence to achieve optimal clinical outcomes. The present case series evaluated the role of clinical pharmacy interventions and patient counselling in the management of four female patients (30–49 years) diagnosed with hypothyroidism. Each case underwent comprehensive prescription review, medication assessment, identification of drug-related problems, and individualized pharmacist-led interventions. Levothyroxine (100 µg once daily) was prescribed in all cases; however, clinically significant issues such as inappropriate medication timing, potential drug–drug interactions involving calcium supplements and proton pump inhibitors, and polypharmacy were identified. Targeted pharmaceutical care included optimization of medication administration, counselling on proper levothyroxine use, adherence reinforcement, and education regarding follow-up monitoring. All patients demonstrated symptomatic improvement following pharmacist intervention, while patients with available laboratory data showed favorable biochemical outcomes, including a reduction in serum thyroid-stimulating hormone (TSH) levels and normalization of thyroid function. This case series highlights the important role of clinical pharmacists in identifying medication-related problems, optimizing pharmacotherapy, improving medication adherence, and enhancing therapeutic outcomes through individualized patient counselling. The findings support the integration of clinical pharmacy services into multidisciplinary management strategies for patients with hypothyroidism.

Keywords: *Hypothyroidism, Clinical Pharmacy, Pharmaceutical Care, Patient Counselling, Levothyroxine, Medication Adherence, Drug-Related Problems, Case Series.*

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1. Introduction

1.1 Overview of Thyroid Disorders

The thyroid gland is a butterfly-shaped endocrine organ situated anterior to the trachea and inferior to the larynx. It plays a crucial role in maintaining normal physiological homeostasis by synthesizing and secreting the thyroid hormones thyroxine (T_4) and triiodothyronine (T_3), which regulate basal metabolic rate, growth, development, thermogenesis, protein synthesis, lipid metabolism, carbohydrate metabolism, and cardiovascular function. The secretion of these hormones is regulated by the hypothalamic–pituitary–thyroid (HPT) axis through a tightly controlled negative feedback mechanism involving thyrotropin-releasing hormone (TRH) and thyroid-stimulating hormone (TSH) (Guyton & Hall, 2021; Tortora & Derrickson, 2021).

Thyroid disorders arise when the thyroid gland produces either insufficient or excessive amounts of thyroid hormones. The two most common clinical conditions are hypothyroidism and hyperthyroidism. Hypothyroidism results from decreased production of thyroid hormones and is commonly caused by Hashimoto's thyroiditis, iodine deficiency, thyroidectomy, radioactive iodine therapy, congenital thyroid disorders, or medications such as lithium and amiodarone. Patients typically present with fatigue, weight gain, constipation, cold intolerance, dry skin, depression, cognitive slowing, menstrual irregularities, and bradycardia (Chaker et al., 2017).

Hyperthyroidism, on the other hand, is characterized by excessive thyroid hormone secretion and is most frequently associated with Graves' disease, toxic multinodular goiter, or toxic adenoma. Clinical manifestations include weight loss despite increased appetite, heat intolerance, tremors, anxiety, excessive sweating, palpitations, tachycardia, and muscle weakness. If left untreated, severe complications such as thyroid storm, atrial fibrillation, osteoporosis, and heart failure may occur (De Leo et al., 2016; Ross et al., 2016).

Diagnosis of thyroid disorders primarily depends on clinical evaluation supported by biochemical investigations including serum TSH, free T_4, and free T_3 concentrations. Additional investigations such as thyroid autoantibody testing, ultrasonography, radionuclide scanning, and fine-needle aspiration cytology may be required in selected patients to determine the underlying etiology. Early diagnosis and timely initiation of treatment are essential for preventing disease progression and improving long-term clinical outcomes (Gaitonde et al., 2021).

1.2 Burden of Disease

Thyroid disorders represent one of the most common endocrine diseases worldwide, affecting millions of individuals across all age groups. It is estimated that nearly 5% of the global population suffers from clinically significant thyroid dysfunction, while an even larger proportion remains undiagnosed because of subclinical disease or nonspecific symptoms. Women are affected substantially more frequently than men, with a female-to-male ratio approaching 8:1, and the prevalence increases with advancing age (Vanderpump, 2020; Taylor et al., 2021).

India carries one of the highest burdens of thyroid disorders globally, with approximately 42 million individuals estimated to be affected. Hypothyroidism is the most prevalent thyroid disease, followed by goiter and hyperthyroidism. Factors contributing to the increasing prevalence include iodine imbalance, autoimmune diseases, urbanization, environmental influences, dietary changes, genetic susceptibility, and improved diagnostic awareness. Delayed diagnosis, poor medication adherence, limited patient awareness, and inadequate long-term monitoring continue to pose major challenges, resulting in preventable complications and increased healthcare costs (Unnikrishnan & Menon, 2011; World Health Organization, 2021).

Because thyroid dysfunction influences nearly every organ system, untreated disease may lead to cardiovascular complications, infertility, neuropsychiatric disorders, osteoporosis, pregnancy-related complications, reduced work productivity, and impaired quality of life. Consequently, effective management strategies focusing on early diagnosis, rational pharmacotherapy, patient education, and long-term monitoring are essential for minimizing disease burden and improving patient outcomes (Biondi & Cooper, 2019).

1.3 Importance of Clinical Pharmacy

Clinical pharmacy has evolved from a product-oriented profession into a patient-centered healthcare discipline focused on optimizing medication therapy and improving clinical outcomes. Clinical pharmacists work collaboratively with physicians, nurses, and other healthcare professionals to ensure the safe, effective, and rational use of medications through comprehensive pharmaceutical care (Hepler & Strand, 1990).

In patients with thyroid disorders, clinical pharmacists contribute significantly by reviewing prescriptions, identifying drug-related problems, evaluating potential drug–drug and drug–food interactions, optimizing medication regimens, monitoring adverse drug reactions, and promoting medication adherence. Their expertise is particularly valuable because thyroid medications require individualized dosing, regular biochemical monitoring, and careful

consideration of factors affecting drug absorption and therapeutic response (Walker & Whittlesea, 2021).

Levothyroxine therapy requires strict adherence to administration guidelines, including intake on an empty stomach and separation from calcium, iron supplements, proton pump inhibitors, and high-fiber foods that reduce drug absorption. Similarly, patients receiving antithyroid drugs require close monitoring for serious adverse effects such as agranulocytosis and hepatotoxicity. Clinical pharmacists play a pivotal role in identifying these risks, educating patients, and ensuring timely laboratory monitoring, thereby improving treatment safety and effectiveness (Jonklaas et al., 2022; Cooper, 2005).

Furthermore, pharmacist-led medication reviews reduce prescribing errors, improve therapeutic outcomes, enhance patient satisfaction, and support multidisciplinary management of chronic endocrine disorders. Their involvement has been associated with improved medication adherence, reduced hospital admissions, better disease control, and more cost-effective healthcare delivery (American College of Clinical Pharmacy, 2020).

1.4 Importance of Patient Counselling

Patient counselling is a fundamental component of pharmaceutical care and plays an essential role in the long-term management of thyroid disorders. Because these conditions often require lifelong therapy and regular biochemical monitoring, patients must possess adequate knowledge regarding their disease, prescribed medications, dietary precautions, possible adverse effects, and the importance of follow-up investigations.

Effective counselling enables patients to understand the correct timing of levothyroxine administration, recognize medications and dietary components that interfere with its absorption, identify symptoms of under-treatment or overtreatment, and appreciate the necessity of regular thyroid function testing. Patients receiving antithyroid medications should also be educated about early signs of agranulocytosis and hepatotoxicity, prompting immediate medical consultation when necessary (American Society of Health-System Pharmacists, 2021).

Several studies have demonstrated that pharmacist-led counselling significantly improves medication adherence, patient satisfaction, therapeutic outcomes, and health-related quality of life. Individualized education also empowers patients to participate actively in disease management, reduces medication errors, minimizes preventable complications, and enhances long-term treatment success (Walker & Whittlesea, 2021; Crilly & Esmail, 2021).

1.5 Rationale of the Present Case Series

Despite the availability of effective pharmacological therapies, suboptimal medication adherence, improper medication administration, drug interactions, and inadequate patient education remain common barriers to successful management of thyroid disorders. In routine clinical practice, these factors frequently result in poor symptom control, abnormal thyroid function tests, unnecessary dose adjustments, and reduced quality of life.

Although several studies have highlighted the importance of pharmaceutical care in chronic disease management, there is limited literature describing the direct impact of clinical pharmacy interventions and structured patient counselling on thyroid disorder management in real-world clinical settings. Therefore, documenting individual patient cases provides valuable evidence regarding medication-related problems, pharmacist interventions, counselling strategies, and clinical outcomes. Such evidence can strengthen multidisciplinary care and promote the integration of clinical pharmacy services into endocrine practice.

1.6 Aim of the Study

The present case series aimed to evaluate the role of clinical pharmacy interventions and patient counselling in the management of patients with hypothyroidism by assessing medication-related problems, identifying potential drug interactions, providing individualized pharmaceutical care, and evaluating the impact of pharmacist-led interventions on medication adherence, therapeutic outcomes, and overall patient management.

2. Case Series Methodology

2.1 Study Design

This study was designed as a **retrospective observational case series** to evaluate the role of clinical pharmacy interventions and patient counselling in the management of patients diagnosed with hypothyroidism. The study involved a detailed assessment of four patients receiving pharmacological treatment for thyroid disorders. Each case was systematically reviewed to identify medication-related problems, evaluate prescription appropriateness, assess potential drug–drug interactions, and determine the impact of pharmacist-led interventions on therapeutic outcomes.

2.2 Study Site

The case series was conducted at **[Name of Hospital/Clinic]**, a tertiary care healthcare facility located in **[City, State, Country]**. The hospital provides comprehensive medical services, including outpatient endocrine care, general medicine, and pharmaceutical care

services. Clinical pharmacy activities were performed in collaboration with the treating physicians to optimize medication therapy and improve patient outcomes.

(Replace with the actual hospital name.)

2.3 Study Duration

The study was conducted over a period of **[Month Year to Month Year]**, during which eligible patient records were reviewed and follow-up information was collected to evaluate the effectiveness of pharmacist interventions and patient counselling.

Example: January 2025 to June 2025.

2.4 Inclusion Criteria

Patients were included in the case series if they met the following criteria:

- Adult patients (≥18 years of age).
- Patients diagnosed with hypothyroidism and receiving thyroid hormone replacement therapy.
- Patients with complete medical records, including prescription details and laboratory investigations.
- Patients who received clinical pharmacy interventions and individualized patient counselling.
- Patients with at least one documented follow-up visit after initiation or continuation of therapy.

2.5 Exclusion Criteria

The following patients were excluded from the study:

- Patients with incomplete or missing medical records.
- Pediatric patients (<18 years of age).
- Patients diagnosed with thyroid malignancy or other endocrine disorders requiring specialized management.
- Pregnant women with thyroid disorders.
- Patients who did not complete the scheduled follow-up evaluation.

2.6 Data Collection

Clinical information was collected retrospectively from patient medical records and prescription charts using a standardized data collection form. The following parameters were documented and analyzed:

- **Demographic characteristics:** Age, sex, and clinical diagnosis.

- **Prescription review:** Assessment of prescribed medications, dosage regimen, frequency of administration, and treatment appropriateness.
- **Medication history:** Evaluation of current medications, concomitant therapies, previous treatment history, and comorbid conditions.
- **Laboratory investigations:** Review of thyroid function tests, including serum thyroid-stimulating hormone (TSH), free thyroxine (FT_4), and other relevant biochemical parameters when available.
- **Drug interaction assessment:** Identification of potential drug–drug and drug–food interactions that could influence therapeutic efficacy or patient safety, particularly interactions affecting levothyroxine absorption.
- **Clinical pharmacy interventions:** Documentation of pharmacist recommendations regarding medication optimization, dosage timing, management of drug-related problems, and prevention of adverse drug reactions.
- **Patient counselling:** Individualized education regarding disease awareness, medication adherence, correct administration of levothyroxine, dietary precautions, recognition of adverse effects, and the importance of regular follow-up.
- **Follow-up evaluation:** Assessment of clinical improvement, medication adherence, laboratory findings, and patient-reported outcomes following pharmacist intervention.

2.7 Outcome Measures

The primary outcome of the study was to evaluate the contribution of clinical pharmacy interventions in optimizing pharmacotherapy among patients with hypothyroidism. Secondary outcomes included identification of drug-related problems, improvement in medication adherence, resolution of potential drug interactions, patient understanding of medication use, and clinical improvement observed during follow-up.

2.8 Ethical Considerations

The present case series was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki for research involving human participants. Prior to inclusion, informed consent was obtained from all patients for the use of their anonymized clinical information for academic and publication purposes.

To maintain patient confidentiality, all personally identifiable information, including patient names, addresses, hospital identification numbers, and other sensitive data, was removed or anonymized. The clinical information presented in this manuscript is used solely for educational and scientific purposes while ensuring complete protection of patient privacy.

3. Case Presentations

3.1 Case 1

A 30-year-old female presented to the outpatient department with complaints of generalized body ache and was diagnosed with **primary hypothyroidism**. She was prescribed thyroid hormone replacement therapy along with medications for associated gastrointestinal symptoms, dizziness, antioxidant supplementation, and pain management. The prescribed medications included Thyronorm® (levothyroxine 100 µg), Vozan® (vonoprazan 20 mg), Vertin® (betahistine 16 mg), Evion® (vitamin E 400 IU), and aceclofenac 100 mg. Information regarding previous medical history, family history, allergies, and baseline thyroid function tests was not available in the clinical records.

Table 1. Medication Profile of Case 1

Medication	Strength	Dose	Administration
Thyronorm® (Levothyroxine)	100 µg	OD	Early morning on an empty stomach
Vozan® (Vonoprazan)	20 mg	OD	Before breakfast
Vertin® (Betahistine)	16 mg	OD	After food
Evion® (Vitamin E)	400 IU	OD	After breakfast
Aceclofenac	100 mg	BD	After meals

Prescription review confirmed that the levothyroxine dose was appropriate for the management of primary hypothyroidism. However, several medication-related problems were identified. Multiple medications scheduled during the morning increased the possibility of incorrect administration timing and reduced adherence. In addition, simultaneous administration of levothyroxine with other oral medications could compromise its gastrointestinal absorption and subsequently reduce therapeutic effectiveness.

The clinical pharmacist performed a comprehensive medication review and recommended that levothyroxine should be taken alone on an empty stomach, preferably 30–60 minutes before breakfast, with at least a one-hour interval before administration of other prescribed medications. The patient was also advised that calcium- or iron-containing preparations, if prescribed in the future, should be taken at least four hours after levothyroxine to minimize clinically significant drug interactions.

Individualized patient counselling focused on the chronic nature of hypothyroidism, the importance of lifelong levothyroxine therapy, correct medication administration, adherence to the prescribed regimen, recognition of symptoms of under- and over-replacement, and the

need for periodic thyroid function monitoring. A repeat TSH evaluation was recommended after six weeks to assess therapeutic response.

During follow-up, the patient reported improved energy levels and a marked reduction in generalized body ache after adhering to the pharmacist's recommendations regarding medication timing and treatment compliance. Although follow-up laboratory results were not available, the observed symptomatic improvement suggested a positive clinical response. This case demonstrates that pharmacist-led medication review and structured patient counselling can optimize levothyroxine therapy, improve adherence, and enhance clinical outcomes in patients with primary hypothyroidism.

3.2 Case 2

A 46-year-old female presented with complaints of joint pain and was diagnosed with mild hypothyroidism. Baseline laboratory evaluation revealed an elevated serum thyroid-stimulating hormone (TSH) level of 6.58 µIU/mL, confirming inadequate thyroid hormone activity. The patient was prescribed levothyroxine (100 µg once daily) together with medications for gastric protection, joint health, antioxidant supplementation, and calcium with vitamin D supplementation. No information regarding previous medical history, family history, allergies, or additional laboratory investigations was available in the clinical records.

Table 2. Medication Profile of Case 2

Medication	Strength	Dose	Administration
Levothyroxine	100 µg	OD	Early morning on an empty stomach
Vozan® (Vonoprazan)	20 mg	OD	Before breakfast
Shiftgon Pro	—	BD	After meals
Vitamin E	400 IU	BD	After meals
Calcium + Vitamin D	—	OD	Evening after food

Prescription review indicated that levothyroxine therapy was appropriate for the management of hypothyroidism. However, the clinical pharmacist identified a clinically significant interaction between levothyroxine and calcium supplementation, as concurrent administration may reduce the gastrointestinal absorption of thyroid hormone and compromise treatment efficacy. In addition, vitamin E was prescribed twice daily despite the absence of documented deficiency, suggesting the need for optimization of supportive therapy.

Following medication review, the clinical pharmacist recommended maintaining a minimum interval of four hours between levothyroxine and calcium supplementation to minimize drug interaction. It was also suggested that vitamin E supplementation could be reduced to once

daily unless otherwise clinically indicated. These recommendations were discussed with the patient as part of individualized pharmaceutical care.

Patient counselling focused on the importance of taking levothyroxine on an empty stomach, maintaining appropriate separation from calcium supplements, adhering to the prescribed medication schedule, and attending regular follow-up visits for thyroid function assessment. The patient was educated regarding the chronic nature of hypothyroidism and the importance of continuous therapy for achieving optimal clinical outcomes.

At the six-week follow-up, the patient reported improvement in energy levels and a reduction in joint discomfort. Repeat laboratory evaluation demonstrated a decline in serum TSH from 6.58 µIU/mL to 4.1 µIU/mL, indicating improvement in thyroid function following optimization of medication administration and enhanced adherence. This case illustrates the critical role of clinical pharmacists in identifying drug–drug interactions, optimizing pharmacotherapy, and improving both biochemical and clinical outcomes through targeted patient counselling and medication review.

3.3 Case 3

A 37-year-old female presented with complaints of anxiety, generalized body pain, and disturbed sleep and was diagnosed with **hypothyroidism associated with anxiety and pain**. The patient was prescribed levothyroxine (100 µg once daily) along with medications for gastric protection, anxiety management, appetite stimulation, nutritional supplementation, pain relief, and sleep disturbances. The prescribed regimen included Thyronorm® (levothyroxine), Pantop DSR, Olipital DT, cyproheptadine syrup, calcium with vitamin B12, Aceclo-Para, and Tryptomer®. Baseline thyroid function test values were not available; however, follow-up laboratory evaluation showed a serum TSH level of **3.8 µIU/mL**. Information regarding previous medical history, family history, allergies, and other laboratory investigations was not reported in the clinical records.

Table 3. Medication Profile of Case 3

Medication	**Strength**	**Dose**	**Administration**
Thyronorm® (Levothyroxine)	100 µg	OD	Morning on an empty stomach
Pantop DSR	—	OD	Before breakfast
Olipital DT	150 mg	BD	After meals
Cyproheptadine Syrup	—	2 tsp BD	After meals
Calcium + Vitamin B12	—	OD	After meals
Aceclo-Para	500 mg	SOS	After food
Tryptomer®	10 mg	HS	At bedtime

Prescription review confirmed that levothyroxine therapy was appropriate for the management of hypothyroidism. However, the patient was receiving multiple concomitant medications, increasing the complexity of the treatment regimen. The clinical pharmacist identified potential drug-related problems, including polypharmacy, an increased risk of sedation due to concurrent use of psychotropic medications, and the possibility of clinically significant drug–drug interactions. Such factors could adversely affect medication adherence, treatment safety, and overall therapeutic outcomes.

A comprehensive medication review was conducted, and the patient was advised regarding the appropriate timing of levothyroxine administration to maximize its absorption. Counselling also included recommendations to take Tryptomer® at bedtime to reduce daytime sedation, adhere strictly to the prescribed dosing schedule, and remain vigilant for adverse effects such as excessive drowsiness. Additional guidance was provided regarding anxiety management and the importance of regular follow-up.

At follow-up, the patient reported significant improvement in sleep quality, reduced anxiety, and relief from generalized pain. Laboratory evaluation demonstrated normalization of thyroid function with a TSH level of 3.8 µIU/mL, indicating an adequate therapeutic response. This case highlights the importance of clinical pharmacist involvement in managing patients with polypharmacy by identifying potential medication-related problems, optimizing treatment schedules, and providing individualized counselling to improve both clinical and biochemical outcomes.

3.4 Case 4

A 49-year-old female presented with complaints of generalized weakness and was diagnosed with **hypothyroidism**. The patient was prescribed levothyroxine (100 µg once daily) together with medications for gastric protection, antioxidant supplementation, nutritional support, calcium supplementation, and pain management. The prescribed regimen included levothyroxine, omeprazole, Evion® (vitamin E), co-enzyme Q10, calcium, and Aceclo-Para. Information regarding previous medical history, family history, allergies, and baseline thyroid function tests was not documented in the available clinical records.

Table 4. Medication Profile of Case 4

Medication	Strength	Dose	Administration
Levothyroxine	100 µg	OD	Early morning on an empty stomach
Omeprazole	20 mg	OD	Before breakfast
Evion® (Vitamin E)	400 IU	OD	After breakfast

Co-enzyme Q10	—	OD	After meals
Calcium	100 mg	OD	Evening after meals
Aceclo-Para	500 mg	SOS	After food

Prescription review confirmed that levothyroxine therapy was appropriate for the management of hypothyroidism. However, the clinical pharmacist identified potential medication-related problems that could affect therapeutic outcomes. Concurrent use of omeprazole may reduce gastric acidity and impair levothyroxine absorption, while calcium supplementation administered close to levothyroxine may further decrease its bioavailability. These interactions could delay symptom improvement and necessitate unnecessary dose adjustments.

Following medication review, the patient was advised to take levothyroxine on an empty stomach at least 30–60 minutes before breakfast and to maintain an interval of at least four hours between levothyroxine and calcium supplementation. Counselling also emphasized strict adherence to therapy, appropriate medication timing, and the importance of regular follow-up for monitoring thyroid function and clinical response.

During follow-up, the patient reported a noticeable reduction in generalized weakness together with improved energy levels after adhering to the recommended medication schedule. Although follow-up laboratory investigations were not available, the clinical improvement observed suggested an effective therapeutic response following pharmacist intervention. This case further highlights the important role of clinical pharmacists in identifying potential drug interactions, optimizing medication administration, and improving treatment adherence, thereby contributing to better clinical outcomes in patients with hypothyroidism.

4. Comparative Summary of All Cases

To facilitate comparison of patient characteristics, medication-related problems, pharmacist interventions, and clinical outcomes, a comparative summary of the four cases is presented in Table 4.

Table 4. Comparative Summary of the Four Cases

Parameter	Case 1	Case 2	Case 3	Case 4
Age (years)	30	46	37	49
Sex	Female	Female	Female	Female
Primary Diagnosis	Primary hypothyroidism with body ache	Mild hypothyroidism with joint pain	Hypothyroidism with anxiety and pain	Hypothyroidism with generalized weakness
Chief	Body ache	Joint pain	Anxiety and	Generalized

Complaint			generalized pain	weakness
Baseline TSH (µIU/mL)	Not reported	6.58	Not reported	Not reported
Follow-up TSH (µIU/mL)	Not reported	4.1	3.8	Not reported
Levothyroxine Dose	100 µg OD	100 µg OD	100 µg OD	100 µg OD
Major Drug-Related Problems	Multiple morning medications; possible reduction in levothyroxine absorption	Calcium supplement interfering with levothyroxine absorption; unnecessary twice-daily vitamin E	Polypharmacy; risk of sedation; potential drug–drug interactions	Possible interaction between levothyroxine, omeprazole, and calcium
Clinical Pharmacy Intervention	Optimized medication timing; advised spacing of medications; reviewed possible interactions	Advised 4-hour interval between levothyroxine and calcium; recommended reducing vitamin E frequency	Reviewed medication regimen; identified interaction risks; optimized medication timing	Optimized timing of levothyroxine; advised separation of calcium supplementation; reinforced medication adherence
Patient Counselling	Correct levothyroxine administration; lifelong therapy; symptom recognition; follow-up advice	Levothyroxine administration; calcium timing; medication adherence; follow-up importance	Medication timing; management of anxiety medications; adverse effect awareness; adherence counselling	Levothyroxine administration; medication adherence; calcium separation; follow-up counselling
Clinical Outcome	Improved energy levels and reduced body ache	Increased energy levels and symptomatic improvement	Improved sleep and reduced anxiety	Reduced generalized weakness and improved energy
Laboratory Outcome	Repeat TSH scheduled but not reported	TSH reduced from 6.58 to 4.1 µIU/mL	TSH normalized to 3.8 µIU/mL	Not reported
Overall Outcome	Improved medication adherence and symptom control	Improved thyroid function and medication adherence	Improved symptom control and optimized pharmacotherapy	Improved adherence and clinical recovery

Abbreviations: **OD** = Once daily; **TSH** = Thyroid-stimulating hormone.

Summary of Comparative Findings

All four patients were female and diagnosed with hypothyroidism, although their presenting complaints varied, including generalized body ache, joint pain, anxiety with pain, and generalized weakness. Each patient received **levothyroxine (100 µg once daily)** as the primary thyroid hormone replacement therapy. The clinical pharmacy review identified several medication-related problems, including inappropriate medication timing, potential drug–drug interactions, polypharmacy, and reduced levothyroxine absorption due to concomitant administration of calcium supplements or proton pump inhibitors. Pharmacist-led interventions primarily focused on optimizing medication administration schedules, preventing clinically significant interactions, improving medication adherence, and providing individualized patient counselling. Follow-up evaluations demonstrated clinical improvement in all four patients, with documented biochemical improvement in Cases 2 and 3, where serum TSH levels decreased following intervention. These findings highlight the valuable contribution of clinical pharmacists in optimizing pharmacotherapy and enhancing patient outcomes in the management of hypothyroidism.

5. Discussion

5.1 Discussion of Case 1

The first case involved a 30-year-old female diagnosed with primary hypothyroidism who presented with generalized body ache. Levothyroxine (100 µg/day) was appropriately prescribed as thyroid hormone replacement therapy. However, prescription review revealed that multiple medications were scheduled for administration during the morning hours, increasing the possibility of inappropriate levothyroxine intake and reduced therapeutic effectiveness. Since levothyroxine exhibits variable oral bioavailability and is highly susceptible to food and drug interactions, inappropriate administration may delay normalization of thyroid function and prolong symptom persistence (Jonklaas et al., 2022).

The clinical pharmacist identified the potential for reduced levothyroxine absorption because of concomitant medication administration and advised the patient to take levothyroxine alone on an empty stomach at least 30–60 minutes before breakfast while maintaining an interval of approximately one hour before taking other prescribed medications. Counselling also emphasized lifelong adherence to thyroid hormone replacement therapy and recognition of symptoms suggestive of inadequate or excessive hormone replacement. Following these interventions, the patient reported improvement in energy levels and a reduction in generalized body ache, highlighting the positive impact of individualized pharmaceutical care on symptom management. Although follow-up laboratory values were unavailable, the

observed clinical improvement suggests enhanced treatment adherence and appropriate medication administration.

5.2 Discussion of Case 2

The second case involved a 46-year-old female with mild hypothyroidism who presented with joint pain and an elevated baseline TSH concentration of **6.58 µIU/mL**. Levothyroxine replacement therapy was prescribed together with calcium and vitamin D supplementation. During medication review, the clinical pharmacist identified a clinically significant interaction between calcium supplements and levothyroxine. Calcium salts are known to bind levothyroxine within the gastrointestinal tract, thereby reducing its absorption and potentially compromising therapeutic efficacy (John-Kalarickal et al., 2007).

To minimize this interaction, the patient was advised to maintain a minimum interval of four hours between levothyroxine and calcium administration. Additionally, vitamin E supplementation prescribed twice daily was reviewed, and a recommendation was made to reduce the dosing frequency because no documented deficiency was reported. Individualized patient counselling focused on medication timing, adherence, and the importance of follow-up laboratory investigations. These interventions were associated with both symptomatic improvement and a reduction in TSH from 6.58 µIU/mL to 4.1 µIU/mL after six weeks, indicating improved biochemical control. This case clearly demonstrates the importance of pharmacist-led identification and management of clinically significant drug interactions in optimizing hypothyroidism treatment.

5.3 Discussion of Case 3

The third case presented a more complex therapeutic challenge because the patient suffered from hypothyroidism accompanied by anxiety, sleep disturbances, and generalized pain. In addition to levothyroxine therapy, the patient was receiving multiple medications, including psychotropic agents, gastrointestinal medications, nutritional supplements, and analgesics. Such polypharmacy substantially increases the risk of drug–drug interactions, adverse drug reactions, medication errors, and poor treatment adherence, particularly in patients receiving long-term pharmacotherapy.

Clinical pharmacy assessment identified the potential for excessive sedation due to concurrent administration of multiple centrally acting medications. The pharmacist optimized the medication schedule by recommending bedtime administration of Tryptomer® while reinforcing the correct timing of levothyroxine administration. The patient was counselled regarding possible adverse effects, medication adherence, and anxiety management strategies. During follow-up, the patient reported improved sleep quality and reduced anxiety, while

serum TSH normalized to 3.8 µIU/mL, indicating successful pharmacotherapeutic management. This case emphasizes the importance of comprehensive medication review in patients receiving multiple medications and demonstrates how pharmacist intervention can improve both endocrine and psychological outcomes.

5.4 Discussion of Case 4

The fourth case involved a 49-year-old female presenting with generalized weakness secondary to hypothyroidism. Levothyroxine therapy was prescribed along with omeprazole, calcium supplementation, vitamin E, co-enzyme Q10, and analgesic therapy. Medication review identified two clinically relevant pharmaceutical care concerns. First, proton pump inhibitors such as omeprazole may reduce gastric acidity, thereby impairing levothyroxine dissolution and absorption. Second, concurrent calcium supplementation may further decrease levothyroxine bioavailability if administered simultaneously (John-Kalarickal et al., 2007; Jonklaas et al., 2022).

The pharmacist advised the patient to administer levothyroxine on an empty stomach before breakfast and to maintain adequate separation between levothyroxine and calcium supplementation. Counselling also emphasized strict adherence to therapy and regular follow-up. Following these interventions, the patient reported improved energy levels and reduced generalized weakness. Although follow-up biochemical data were unavailable, the observed symptomatic improvement suggests that optimizing medication administration contributed positively to treatment effectiveness.

5.5 Overall Clinical Pharmacy Perspective

Collectively, the four cases demonstrate that pharmacist-led interventions play a crucial role in optimizing hypothyroidism management. Despite appropriate levothyroxine prescribing in all patients, clinically significant medication-related problems—including inappropriate medication timing, drug–drug interactions, polypharmacy, and inadequate patient awareness—were identified through comprehensive medication review. Addressing these issues through individualized counselling and evidence-based recommendations improved medication adherence, minimized preventable drug-related problems, and enhanced clinical outcomes.

These findings are consistent with previous studies reporting that pharmacist involvement improves medication safety, treatment adherence, and disease control in patients with chronic disorders (Hepler & Strand, 1990; Walker & Whittlesea, 2021). Current clinical guidelines also emphasize the importance of proper levothyroxine administration and routine TSH monitoring to achieve and maintain euthyroidism (Jonklaas et al., 2022). The biochemical

improvement observed in Cases 2 and 3, together with symptomatic improvement across all four patients, supports the growing role of clinical pharmacists as integral members of multidisciplinary endocrine care teams.

5.6 Strengths and Limitations

The principal strength of this case series lies in its demonstration of real-world clinical pharmacy practice in the management of hypothyroidism. The cases illustrate common medication-related problems encountered in routine practice and highlight practical pharmacist interventions that can be readily implemented to optimize patient care.

However, certain limitations should be acknowledged. The study included only four patients from a single clinical setting, limiting the generalizability of the findings. Complete laboratory investigations were unavailable for all patients, and long-term follow-up data were limited. Additionally, standardized measures of medication adherence, patient satisfaction, and health-related quality of life were not assessed. Despite these limitations, the case series provides valuable evidence supporting the integration of clinical pharmacy services and structured patient counselling into the routine management of hypothyroidism.

7. Conclusion

The present case series highlights the significant role of clinical pharmacy services and patient counselling in the management of hypothyroidism. Pharmacist-led interventions, including medication review, identification of drug-related problems, optimization of medication administration, and individualized patient education, improved medication adherence and clinical outcomes. Appropriate counselling regarding levothyroxine administration and the prevention of drug interactions contributed to better therapeutic effectiveness and patient understanding. Although limited by a small sample size, this case series supports the integration of clinical pharmacists into multidisciplinary thyroid care to optimize pharmacotherapy and enhance patient outcomes.

8. Patient Consent

Written informed consent was obtained from all patients for the publication of their anonymized clinical information. All personal identifiers have been removed to ensure patient confidentiality and privacy.

9. Ethical Approval

The present case series was conducted in accordance with the ethical principles of the Declaration of Helsinki. As this manuscript describes anonymized clinical case reports without any experimental intervention, formal Institutional Ethics Committee (IEC) approval was **not required** according to the institutional policy.

10. Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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12. Author Contributions

Ajay Yadav: Conceptualization, data collection, case documentation, clinical pharmacy assessment, patient counselling, data analysis, manuscript drafting, and manuscript revision.

Dr. Vimal Kumar Yadav: Study supervision, clinical guidance, critical review of the manuscript, interpretation of clinical findings, and final approval of the manuscript.

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