

Case Report

## Rapidly Progressive Anaplastic Thyroid Carcinoma Concurrent with SARS-CoV-2 Infection and Acute Renal Failure: A Challenging Case

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### Abstract

*The co-occurrence of aggressive malignancies like anaplastic thyroid carcinoma (ATC) and severe viral infections such as SARS-CoV-2 poses profound clinical challenges, particularly when complicated by rapid multi-organ dysfunction. We present a rare case of a 58-year-old Arabic male with a history of multinodular goiter who presented with a rapidly enlarging neck mass. Subsequent histopathological analysis diagnosed the mass as ATC, concurrent with a confirmed SARS-CoV-2 infection. The patient's clinical course was further complicated by the rapid onset of acute renal failure. This case exemplifies the intricate diagnostic complexities, the profound impact of the viral infection and escalating multi-organ failure on surgical deferral, and the relentless, rapid progression of ATC despite palliative radiotherapy, culminating in respiratory and renal failure. Despite the implementation of supportive and palliative measures, the patient succumbed to their condition two weeks after admission. This report underscores the immense difficulties in managing oncologic emergencies amidst active viral infections and severe systemic complications, highlighting the critical need for highly individualized and carefully considered treatment strategies.*

**Keywords:** Anaplastic Thyroid Carcinoma, SARS-CoV-2, COVID-19, Thyroid Cancer, Viral Infection, Oncologic Emergency, Rapid Progression, Acute Renal Failure.

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## Introduction

Anaplastic thyroid carcinoma (ATC) is a rare and exceptionally aggressive endocrine malignancy, notorious for its rapid growth, extensive local invasion, and dismal prognosis (Sung et al., 2021; Thyroid Cancer | Cancer of the Thyroid | American Cancer Society, n.d.). ATC, while comprising a minute fraction of all thyroid cancers, has been associated with significantly worse outcomes in comparison with differentiated thyroid cancers (Piomchai et al., 2012; Sahin et al., 2021; Smallridge et al., 2012; Sung et al., 2021). Patients frequently present with a rapidly enlarging neck mass, often accompanied by severe symptoms like hoarseness, dysphagia, and dyspnea due to invasion of vital surrounding structures (Ursino et al., 2014). Airway obstruction is a dire and life-threatening complication that demands immediate intervention. The ongoing SARS-CoV-2 pandemic has introduced unprecedented complexities into the management of diverse medical conditions, including cancer, potentially disrupting treatment timelines, altering therapeutic strategies, and adversely impacting patient outcomes (Sahin et al., 2021). Furthermore, the presence of concurrent viral infections and their associated multi-organ complications, such as acute renal failure, can dramatically exacerbate the severity and clinical trajectory of underlying conditions (Gracia-Ramos et al., 2021; Uribarri et al., 2020). We present a compelling case of ATC diagnosed in a patient with concurrent SARS-CoV-2 infection, further complicated by acute renal failure. This case underscores the formidable challenges in management and the relentless aggressiveness of this malignancy within such a multifaceted clinical context. Despite the extensive research conducted on both ATC and COVID-19 individually, there is a paucity of literature addressing their co-occurrence. This case report contributes to the limited evidence on the clinical implications of simultaneous ATC and SARS-CoV-2 infection.

## Case Presentation

A 58-year-old Arabic male with a medical history of type 2 diabetes mellitus and longstanding multinodular goiter presented to the emergency department with a rapidly enlarging neck mass over two weeks, accompanied by progressive hoarseness, dysphagia to solids, and mild dyspnea on exertion. The patient denied any history of malignancies or family history of thyroid cancer. Three days prior to admission, the patient exhibited fever (38.5°C), a dry cough, generalized fatigue, and mild shortness of breath. Nasopharyngeal swab testing yielded positive results for SARS-CoV-2 infection via PCR. Upon physical examination, the patient was noted to be alert and afebrile, a consequence of prior antipyretic administration. Oxygen saturation levels were recorded at 92% while breathing room air. A thorough

examination of the neck region revealed the presence of a firm, non-tender, fixed mass measuring approximately 7 cm in the anterior neck region, resulting in significant displacement of the trachea to the right. No palpable cervical lymphadenopathy was observed. A respiratory examination revealed reduced air entry over the right lung base, but no crepitations or wheezes were detected.

The diagnostic workup included the following:

- A combination of neck ultrasound and contrast-enhanced CT scan revealed a sizable, heterogeneous left thyroid mass measuring approximately  $7.2 \times 6.5$  centimeters. This mass demonstrated active invasion of adjacent soft tissues, compression of the trachea, and extension into the superior mediastinum (Pavlidis et al., 2023; Piromchai et al., 2012).
- The histopathological diagnosis was determined by biopsy, which revealed the presence of highly pleomorphic giant cells and spindle cells with extensive necrosis. Immunohistochemistry revealed positive staining for both keratin and PAX8, thereby confirming the diagnosis of anaplastic thyroid carcinoma (Pavlidis et al., 2023; Piromchai et al., 2012).
- The laboratory findings included elevated C-reactive protein (CRP) levels of 80 mg/L, normal thyroid-stimulating hormone (TSH) and free triiodothyronine (free T4) levels, mild lymphopenia, elevated D-dimer levels, and blood glucose levels ranging from 200 to 250 mg/dL. During the patient's hospitalization, acute kidney injury manifested, accompanied by rapidly rising serum creatinine levels (peaking at 4.2 mg/dL from a baseline of 0.9 mg/dL) and blood urea nitrogen (BUN) levels of 85 mg/dL, with concomitant oliguria. Concurrently, the serum potassium level increased to 6.1 mEq/L.

In light of the oncologic emergency of impending airway compromise and the patient's rapidly deteriorating overall condition, including the development of acute renal failure, the patient was admitted to a negative-pressure isolation unit. The management of patients with the disease was characterized by the provision of oxygen supplementation, dexamethasone, anticoagulation, and meticulous glucose control (Pavlidis et al., 2023; Smallridge & Copland, 2010). Airway precautions were prioritized; however, due to the advanced stage of the disease, concurrent positive results for the novel coronavirus (SARS-CoV-2), and the acute onset of renal failure, aggressive surgical intervention was deemed unfeasible and thus deferred. Despite the initiation of palliative radiotherapy, the tumor exhibited unrelenting and rapid progression, accompanied by escalating respiratory distress. Despite the implementation of maximal supportive care, the patient's condition continued to deteriorate, ultimately resulting in a tragic outcome characterized by combined

respiratory and renal failure two weeks after admission. Although tracheostomy is frequently contemplated in the context of acute respiratory failure to alleviate airway obstruction, it was not pursued due to the patient's unstable condition, acute renal failure, and the

risks associated with active severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. A concise synopsis of the patient's clinical trajectory is delineated in **Table 1**, emphasizing the accelerated progression of the disease.

**Table 1.** Timeline of Clinical Events

Day	Clinical Event
-14	Onset of neck mass and hoarseness
-3	Development of fever and dry cough; SARS-CoV-2 confirmed via PCR
0	Hospital admission
+1	Imaging and biopsy confirmed anaplastic thyroid carcinoma (ATC)
+3	Onset of acute kidney injury
+4	Initiation of palliative radiotherapy
+14	Patient succumbed to multi-organ failure

## Discussion

This case exemplifies the significant diagnostic and therapeutic challenges encountered in a patient with rapidly progressive acute tubular cell (ATR) disease diagnosed concurrently with severe acute respiratory syndrome (SARS)-coronavirus 2 (SARS-CoV-2) infection, further complicated by the acute onset of renal failure. This scenario underscores the considerable intricacies inherent in the management of an aggressive malignancy in the context of an active viral illness and emergent multi-organ dysfunction (Smallridge et al., 2012). The patient's pre-existing multinodular goiter is a recognized risk factor for thyroid cancer, though the rapid onset and aggressive morphology of the mass were highly indicative of ATC (Kebebew et al., 2005; Molinaro et al., 2017). ATC is widely recognized for its rapid progression and formidable local invasion (Molinaro et al., 2017). The presence of concurrent SARS-CoV-2 infection introduced a significant degree of complexity, substantially impacting treatment decisions and likely contributing to the patient's rapid deterioration (Bible et al., 2021; Pakkianathan et al., 2025). Patients diagnosed with cancer are widely acknowledged to be susceptible to the severe consequences of SARS-CoV-2 infection. The progression of acute renal failure further exacerbated the already critical clinical state, significantly increasing the patient's overall risk of morbidity and mortality (Di Paola et al., 2023; Uribarri et al., 2020). Acute kidney injury has been thoroughly documented as a complication in severe cases of the novel coronaviruses, particularly in cases of severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). This complication has been shown to be associated with poorer outcomes, particularly in patients with critical illness and those with underlying comorbidities (Serraino et al., 2021).

The systemic inflammation that is prevalent in both advanced cancer and severe cases of the novel coronavirus disease (NCD) has been termed a "cytokine storm" in the latter condition (Dai et al., 2020; Lee et al., 2020; Serraino et al., 2021). It is likely that this inflammation contributed to the development and severity of the acute renal failure. The decision to defer surgical intervention, which is often a critical, potentially life-saving measure for airway compromise in ATC, was profoundly influenced by the active SARS-CoV-2 infection and the substantial associated risks of surgery in this context. This decision is further complicated by the presence of acute renal failure, which introduces significant complications regarding anesthesia, medication clearance, and overall postoperative recovery (Dai et al., 2020; Serraino et al., 2021; Steenblock et al., 2023). The prevailing clinical guidelines underscore the paramount importance of airway management in the context of ATC (Bible et al., 2021; Smallridge et al., 2012). Nevertheless, the aggregate risks of surgical and postoperative complications in patients with active SARS-CoV-2 infection and acute organ dysfunction constitute a substantial concern. Despite the implementation of palliative radiotherapy, ATC has demonstrated a notable resistance to radiation, particularly in its advanced stages (Yang et al., 2021). Novel therapeutic strategies, including targeted therapies, are continuously being explored to improve outcomes in ATC. However, the applicability of these strategies to rapidly deteriorating, multi-morbid patients remains challenging (Saini et al., 2018; Subbiah et al., 2018). In such cases, molecular profiling (e.g., BRAF mutation testing) is not feasible due to the emergent need for palliative care and rapid clinical decline, precluding consideration of targeted therapies. The elevated inflammatory markers (CRP, D-dimer) could be attributed to the aggressive tumor, the viral infection,

and the multi-organ dysfunction, making it exceedingly challenging to differentiate their individual contributions to the patient's critical clinical status. The rapid and relentless progression of ATC in this patient, despite palliative treatment, underscores the aggressive nature of this malignancy. The impact of concurrent SARS-CoV-2 infection or subsequent organ failures on tumor biology and the progression of the disease remains uncertain. However, the profound systemic inflammation and potential immune dysregulation associated with both SARS-CoV-2 and critical illness could theoretically have played a role. It is imperative that further dedicated research be conducted to achieve a comprehensive understanding of the intricate interplay between SARS-CoV-2, multi-organ failure, and aggressive cancers like ATC. This compelling case underscores the critical need for a multidisciplinary approach to the management of complex cases involving oncologic emergencies, concurrent severe infections, and rapid-onset organ failure. This case study also illustrates the significant challenges associated with providing optimal care when standard treatment options are severely limited by active viral illness and severe systemic complications. In such dire clinical situations, meticulous consideration of treatment strategies is paramount. This entails a careful balancing of oncologic needs with the formidable risks of concurrent infection and organ dysfunction. However, this remains a hypothesis, as current clinical evidence is limited regarding the direct impact of SARS-CoV-2 on tumor aggressiveness. Further research is necessary to elucidate this potential interaction.

## Conclusion

This case report offers a compelling illustration of the considerable diagnostic and therapeutic challenges encountered in a patient with rapidly progressive acute tubular necrosis (ATN) and concurrent severe acute respiratory syndrome (SARS)-coronavirus 2 (SARS-CoV-2) infection, further complicated by the acute onset of renal failure. The coexistence of the viral infection and subsequent multi-organ dysfunction significantly impacted critical treatment decisions, and the patient exhibited a relentless and rapid decline despite all palliative measures. This case underscores the vital importance of thoroughly considering and aggressively managing concurrent infections and multi-organ complications in patients afflicted with aggressive cancers. It also highlights the urgent need for further research into the complex potential interactions between SARS-CoV-2, acute organ failure, and underlying malignancies. This case underscores the significance of timely multidisciplinary planning for airway management and decision-making in patients with similarly high oncology risk.

## Declarations

### Ethics approval and consent to participate

Ethical approvals were obtained from the Council of the Iraqi Board of Medical Specialization.

### Consent for Publication

Not applicable.

### Availability of Data and Material

The data that supports the findings of this study are available from the corresponding author upon reasonable request.

### Conflicts of Interest / Competing Interests

The authors declare that there are no conflicts of interest.

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### Author Contributions

A.S.N: Formal analysis, Writing of the original draft, Writing – review & editing.

R.S.A: Methodology, Data curation, Writing of the original draft.

A.H.A: Software, Investigation, Visualization.

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### Use of Generative AI and AI-Assisted Technologies

The authors declare that no generative AI or AI-assisted technologies were used in the preparation of this work.

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