Jurnal Kedokteran dan Kesehatan: Publikasi Ilmiah Fakultas Kedokteran Universitas Sriwijaya
Volume 11, No 1. 2024/DOI: 10.32539/JKK.V11I1.227
p-ISSN 2406-7431; e-ISSN 2614-0411
Page: 32-38

THYROID CRISIS AS THE CAUSE OF SUDDEN DEATH: AN AUTOPSY FINDING

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ARTICLE INFO

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Keywords:
Autopsy
Hyperthyroidism
Sudden Death
Thyroid Crisis
Thyroid Storm

Kata kunci:
Autopsi
Hipertiroidisme
Kematian Mendadak
Krisis Tiroid
Badai Tiroid

Original Submisson:
20 Oktober 2023;
Accepted:
28 Desember 2023;
Published:
17 Januari 2024;

ABSTRACT

Sudden death can occur due to previously known or undiagnosed thyroid diseases. This case reports the death of a 21-year-old woman with symptoms suggestive of thyroid crisis. The victim's family suspected foul play based on physical findings on the body. However, police investigation and autopsy results revealed a history of pre-existing thyroid disease. The autopsy findings showed enlargement of the thyroid gland and lung edema. Forensic histology also revealed chronic inflammation in the thyroid gland and bleeding in the lung tissue. In conclusion, the victim's death was attributed to poorly controlled hyperthyroidism which leads to thyroid crisis. This case highlights the importance of proper management and treatment of thyroid diseases, as well as knowledge of physical signs related to postmortem changes. In this context, the case does not fulfill criminal elements but is more related to the pre-existing health condition of the victim. Therefore, a comprehensive analysis is conducted, considering the available information, including the victim's medical history, witness testimonies, autopsy findings, and other relevant evidence. The investigation of this case holds broad significance, not only in the medical and forensic aspects but also in terms of legal and justice implications.

ABSTRACT

Kematian mendadak dapat terjadi akibat penyakit tiroid yang sebelumnya diketahui ataupun tidak terdiagnosis. Kasus ini melaporkan kematian seorang perempuan berusia 21 tahun dengan gejala-gejala yang mengarah pada krisis tiroid. Keluarga korban menduga adanya tindak kriminal berdasarkan temuan fisik pada tubuh korban. Namun, berdasarkan penyelidikan kepolisian dan hasil autopsi menunjukkan adanya riwayat penyakit hipertiroid sebelumnya. Hasil autopsi menunjukkan adanya pembesaran kelenjar tiroid dan edema paru. Histologi forensik juga mengungkapkan adanya peradangan kronis pada kelenjar tiroid serta kongesti dan perdarahan jaringan paru-paru. Kesimpulannya, kematian korban ini disebabkan oleh keadaan krisis tiroid. Kasus ini menekankan pentingnya pengelolaan dan pengobatan yang tepat pada penyakit tiroid, serta pengetahuan tentang tanda-tanda fisik yang terkait dengan perubahan postmortem. Kasus ini tidak memenuhi unsur pidana dan lebih berkaitan dengan masalah kesehatan yang sebelumnya dimiliki oleh korban. Oleh karena itu, analisis menyeluruh dilakukan terhadap sebuah kejadian kematian mendadak dengan memperhitungkan informasi yang tersedia, termasuk riwayat medis korban, keterangan saksi, temuan autopsi, dan bukti-bukti lain yang relevan. Investigasi kasus ini memiliki signifikansi yang luas, tidak hanya dari segi medis dan forensik, tetapi juga memiliki implikasi yang penting dalam konteks hukum dan keadilan.

INTRODUCTION

A thyroid crisis, which is also referred to as a thyroid storm, is a severe and potentially life-threatening complication of hyperthyroidism characterized by the simultaneous dysfunction of multiple bodily systems. With a mortality rate estimated at 10%, it is important to do an immediate diagnosis and administer emergency care.[1] Thyroid crisis can occur in individuals with either diagnosed or undiagnosed hyperthyroidism due to additional triggering factors, such as trauma, infections, surgery, sudden discontinuation of anti-thyroid medications, burns, brain injury, or pregnancy. While it is more frequently associated with Graves' disease, it can also manifest in other forms of hyperthyroidism, such as toxic multinodular goiter, toxic thyroid adenoma and in cases of thyroiditis.[2,3]

Globally, there are around 300 million individuals with a history of thyroid disorders, but over half of them are unaware of their condition. While thyroid crisis, represents approximately 1-2% of hospital admissions, with an incidence rate ranging from 4.8 to 5.6 cases per 100,000 individuals annually among hospitalized patients.[4] In 2015, Indonesia ranked highest among Southeast Asian countries in the number of individuals affected by thyroid disorders, with an estimated 1.7 million cases. The prevalence of thyroid disorders in Indonesia further increased in 2017, reaching a peak of 17 million cases.[5]

These figures highlight the importance of thyroid health awareness and monitoring. Many individuals suffer from thyroid disorders without recognizing the emerging symptoms. Moreover, according to a European study, the prevalence of undiagnosed subclinical and clinical hyperthyroidism is 0.9% and 0.1%, respectively. This could potentially lead to a thyrotoxicosis state and subsequently develop into thyroid crisis, thus increasing the risk of mortality if not promptly addressed. Hyperthyroidism can also cause cardiovascular problems that contribute to mortality, and higher levels of FT4 are also associated with an increased risk of sudden cardiac death, even within the normal range of thyroid function.[6,7]

Sudden death can be attributed to known thyroid disorders. There are also cases where undiagnosed thyroid disorders lead to sudden death. Even in individuals with known thyroid disorders, sudden death can occur due to conditions like Graves' disease, toxic multinodular goiter, or chronic thyroiditis.[8,9] Here, we have presented a case involving the sudden death of a young woman. This situation raises questions about the possibility of foul play contributing to her demise, as suspected by her family, or whether her death was solely a result of her underlying medical condition. Therefore, the purpose of this case report is to thoroughly analyze the sudden death case by considering available information, including the victim's medical history, witness statements, autopsy findings, and other relevant evidence. Investigating this case is not only crucial for medical and forensic purposes but also holds significant implications in terms of legal and ethical considerations.

CASE

Patient History

A 21-year-old woman was brought to a private hospital in Tangerang by her boyfriend. Upon arrival at the hospital, the victim was pronounced dead. According to the boyfriend's statement, the victim had complained of feeling unwell, prompting him to pick her up and take her

to his residence. The victim had also complained of fever, chills, sweating, vomiting, and shortness of breath.

After the victim's family was contacted, they became suspicious of a criminal act involving assault leading to her death and requested an autopsy. According to the family, one day before the victim's death, she had called the family to inform them that she was in good health. Furthermore, the clothing worn by the victim was not hers, but rather belonged to her boyfriend who brought her to the hospital. The victim was also found not wearing undergarments such as a bra or underwear. The family also harbored suspicions regarding findings on the victim, including the presence of fecal residue on her pants and the presence of bruises on the back of her neck, back, and lower limbs.

However, according to statements from witnesses obtained from the police, the victim had previously sought medical treatment and was reported to have been diagnosed with hyperthyroidism around 1 month before. At that time, the victim complained of frequently experiencing palpitations and not menstruating for 4 months. The victim was also suspected of not adhering to regular check-ups and medication, resulting in recurring complaints.

About 20 hours after the victim was pronounced dead, she was transferred to a government hospital for an autopsy.

External Examination

The external examination revealed a well-nourished body with distinct indicators of death, such as postmortem lividity persisting on the back without fading upon pressure and loosening rigor mortis in the fingers, jaw, and upper and lower extremities, which were typical postmortem changes. The body also exhibited several abrasions on the front left side of the neck with reddish-brown coloring.

Internal Examination

Upon internal examination, red-colored neck muscles were observed, with no evidence of blood seepage. This suggests that the identified abrasion may not be directly linked to the cause of death, as seen in cases involving strangulation or direct trauma to blood vessels. Notable abnormal findings included enlarged thyroid glands on both sides, frothy fluid in the trachea, and the presence of reddish-black fluid in the stomach. The lungs also appeared edematous, with fluid expressed on their surfaces. Furthermore, dilated blood vessels were found in the brain, both the cerebrum and cerebellum, small intestine, and large intestine.

Special Investigation

Forensic histology examination revealed a tumor in the thyroid gland, chronic inflammation in the thyroid gland and stomach, bleeding in the stomach and lung tissues, as well as blood pooling in the pulmonary blood vessels.

Based on the medical history, autopsy findings, and forensic histology examination, the cause of death in this case was attributed to thyroid crisis, and it was concluded that this case did not meet the criteria for criminal actions as suspected before.

DISCUSSION

Thyroid crisis is an acute and severe state of thyrotoxicosis which is a condition characterized by elevated thyroid hormone levels in the body, which can be life-threatening if not promptly treated. Deaths often occur due to complications such as heart failure, irregular heart rhythm, seizures, or coma. The most common cause of thyroid crisis is Graves' disease, but it can also be associated with other thyroid conditions such as thyroid adenoma, toxic multinodular goiter, and in rare cases, subacute thyroiditis. Thyroid crisis typically occurs in individuals with pre-existing thyroid disorders and can be triggered by events like infections, heart attacks, diabetic ketoacidosis, or pregnancy.[10,11]

The most frequent manifestations of thyroid crisis include fever, cardiovascular involvement, central nervous system manifestations, and gastrointestinal symptoms. High fever above 40ºC accompanied by sweating is a common symptom in thyroid crisis cases. Cardiovascular manifestations can encompass tachycardia with a heart rate exceeding 140 beats per minute, heart failure with fluid accumulation in the lungs and extremities, low blood pressure, arrhythmias, and in severe cases, cardiac arrest leading to death. Central nervous system involvement can present as delirium, hallucinations, seizures, or coma. Gastrointestinal symptoms may include nausea, vomiting, diarrhea, abdominal pain, bowel obstruction, and acute liver failure.[11,12]

In this case, the victim is known to have a history of diagnosed hyperthyroidism based on witness statements and had previously complained of abdominal pain and palpitations. On the day the victim passed away, she experienced fever, chills, vomiting, shortness of breath, and seizures, leading to her being admitted to the hospital. The victim also reported feeling hot and sweaty, which could explain why she wasn’t wearing her own clothes and not wearing undergarments upon arrival at the hospital.

The autopsy examination of the victim revealed enlarged thyroid glands on both sides, and the histopathological result of these thyroid glands showed a tumor with chronic inflammation, indicating chronic thyroiditis. Chronic thyroiditis is usually associated with hypothyroidism, which seems contradictory to the victim's medical history. However, a case report by Harada et al. suggested the possibility of the victim having painless thyroiditis as a variant of chronic thyroiditis during the onset of thyrotoxicosis. Both painless thyroiditis and chronic thyroiditis are known to contribute to a thyrotoxic state. There is also a possibility that the victim had Graves' disease along with painless thyroiditis and chronic thyroiditis. However, these suspicions need to be confirmed through pre-mortem and post-mortem thyroid function test data such as Thyroid Stimulating Hormone (TSH) and free T4 levels.[13–15]

Furthermore, chronic thyroiditis is found in 20-40% of euthyroid autopsy cases and is associated with serological evidence of autoimmunity, particularly the presence of anti-TPO antibodies. The most common clinical cause of chronic thyroiditis is Hashimoto's thyroiditis, an autoimmune disorder. A case report by Shahbaz et al. presents a patient with Hashitoxicosis, wherein the initial stage of the disease, the patient exhibited Graves' disease hyperthyroidism manifestations that later evolved into Hashimoto's thyroiditis hypothyroidism after 2 years. This disease represents a chronic autoimmune condition characterized by a gradual thyroid failure with or without goiter. Hashitoxicosis is the hyperthyroid phase of this disease. This condition arises from the destruction of thyroid follicles due to an inflammatory process, leading to the release of

thyroid hormones into the bloodstream. Examination of anti-TPO antibodies and anti-TG antibodies can also be conducted to support the suspicion of Hashimoto's thyroiditis.[16]

Several complications that can occur due to thyroid crisis include congestive heart failure, myocardial infarction, heart block, pulmonary thromboembolism, cerebrovascular disease, myocarditis, and various types of arrhythmias such as sinus tachycardia, atrial fibrillation, and ventricular fibrillation.[8] In a case presented by Lynch et al., a previously undiagnosed Graves' disease led to sudden death. Upon examination of internal organs, no abnormalities were found except for pulmonary edema. Considering these circumstances, it was assumed that the patient passed away in a hypermetabolic state that resulted in congestive heart failure and acute pulmonary edema. The cause of the patient's death was suspected to be related to a thyroid crisis, leading to cardiac arrhythmias.[10]

There were also other similar cases reported. A case by Wei et al. documented an unexpected and sudden fatality involving a 30-year-old woman linked to Graves' disease. The autopsy revealed diffuse enlargement of the thyroid, heart, and left ventricular hypertrophy. In the case presented, the fatal mechanism stemmed from cardiac arrhythmia due to Graves' disease.[8] Likewise, Takahashi et al. presented an unforeseen case of sudden demise in a 30-year-old woman attributed to congestive heart failure resulting from a thyroid crisis associated with autoimmune thyroiditis. The autopsy findings were an enlarged heart, edematous lungs, and an enlarge pyramidal lobe of the thyroid with fibrosis and infiltration of lymphocytes and plasma cells.[9]

In addition, Sano et al. described a case concerning a thyroid storm in Graves' disease that manifested as severe congestive heart failure. The patient succumbed four days before being admitted to critical care. The autopsy revealed enlarged heart and diffuse enlargement of the thyroid with follicular hyperplasia with vacuolated colloid, papillary infoldings of the epithelial cells. Unlike the studies by Wei et al. and Takahashi et al., this case did not entail sudden death.[17] Nonetheless, all the studies share commonalities regarding the fundamental cause of death, which is linked to cardiac abnormalities associated with hyperthyroidism.

Regarding this case, there is a complication known as thyroid crisis. This condition leads to a sudden and intense exacerbation of thyrotoxicosis symptoms. This rare complication often occurs in patients with hyperthyroidism, especially when the condition is undetected or inadequately treated. Common triggers for this condition include infections, trauma, radioiodine treatment, sudden discontinuation of antithyroid medications, and pregnancy.[2] The victim experienced a hypermetabolic state with tachycardia, causing an increased workload on the heart. This could ultimately result in congestive heart failure and excessive fluid accumulation in the lungs, known as acute pulmonary edema, which is also present in the victim’s autopsy. Acute pulmonary edema is a serious complication that can hinder gas exchange and disrupt respiratory function.

Moreover, the victim's family suspected foul play due to the presence of bruises on the body. This phenomenon is known as livor mortis or postmortem lividity, which involves a reddish or bluish-purple discoloration occurring on the lower parts of the body. Livor mortis happens when superficial blood vessels become distended by gravity-driven blood flow. However, it's often mistaken for bruises by the layperson. Within the first 12 hours after death, blanching of the livor caused by local pressure applied to the outer body surface can help differentiate livor mortis with bruises caused by trauma. Yet, when pressure is applied to areas with bruises due to trauma, blanching won't occur. In the later postmortem stage, incising the doubtful area can reveal distinct differences, as there are no signs of bleeding in the tissues beneath the livor mortis.[18–20] In this case, incisions were made in regions with visible bruises, and no signs of blood seepage were

found in the underlying tissues, leading to the conclusion that the bruises on the victim's body were due to livor mortis.

Furthermore, the presence of fecal residue on the victim's pants is due to the relaxation of the anal sphincter. After death occurs, the body undergoes rigor mortis, or the stiffening of the body. However, before rigor mortis sets in, there is a stage of total relaxation (primary) of the muscles that occurs immediately after death. The decrease in muscle tone can lead to the expulsion of urine, ejaculate, or feces.[18,19]

CONCLUSION

In conclusion, this case report highlights the importance of thorough investigation and autopsy in cases of suspicious death. This case serves as a reminder of the potential dangers posed by untreated thyroid disorders, particularly thyrotoxicosis. It emphasizes the necessity of proper management, regular medical follow-up, and adherence to prescribed treatment regimens for patients with thyroid dysfunction. Furthermore, this case also highlights the significance of accurate postmortem examinations to differentiate between postmortem changes and evidence of violent actions. Lastly, this case report is expected to contribute to medical literature by providing an understanding of the importance of early diagnosis of thyroid diseases and effective treatment. It should also serve as a guide for enhancing investigations into suspicious deaths.

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