Clinical Profile and Outcomes of Thyroid Storm at the University of Santo Tomas Hospital: A 10-year Retrospective Review in the 21st Century

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Abstract

Background: Thyroid storm (TS) continues to be a diagnostic and therapeutic challenge. It is a life-threatening severe thyrotoxicosis characterized by organ decompensation. This study aims to determine if there are any changes in this present century about TS diagnosis and management. Furthermore, it aims to describe the clinical profile, precipitants, and outcomes of patients with TS seen at the University of Santo Tomas Hospital (USTH) and assess the association of patient characteristics with mortality.

Methods: This is a retrospective cohort analysis of patients with TS admitted at USTH from 2009 through 2018. Logistic regression analysis was used to determine the association of age, Burch Wartofsky-Point Scale (BWPS) score, clinical manifestations, and precipitating factor with mortality.

Results: A total of 21 cases were identified. Majority of the patients were female (90.48%) with a mean age of 42.90 years old. The overall mean BWPS was 49.52 (16.35) while those who expired had higher mean score of 61.67 (5.77). TS as the first clinical presentation was seen in only one patient (4.7%) while majority were previously diagnosed with hyperthyroidism, (95.24%). Graves' disease (90.48%) was the most common etiology of thyrotoxicosis. Cardiac manifestations were predominant and tachycardia was the most common clinical manifestation (80.95%) with thyrotoxic heart disease as a comorbidity (23.81%). The most common precipitant was infection (52.38%) followed by noncompliance with treatment. The mean hospital length of stay was four days with two patients needing intubation, and both expired afterward. There were three mortalities (14.29%) due to multiple organ dysfunction and fatal arrythmia.

Conclusion: TS remains a life-threatening condition. Aggressive treatment is justified once with suspicion of TS. Age, BWPS on admission, clinical manifestation and precipitants did not predict the likelihood of mortality. Since predictive features are still not thoroughly identified due to its infrequency, it remains for us to be vigilant and not delay crucial treatment to improve the morbidity and mortality associated with TS.

Keywords: *Thyroid storm, BWPS, Burch-Wartofsky point scale, precipitating factor, outcome*

Introduction

Thyroid storm (TS) is a life-threatening condition in thyrotoxic patients triggered by severe stress and manifested as systemic decompensation. It is an endocrine emergency first described in 1926.[1] Multiple factors such as age, comorbidity, rapidity of onset, and the absence or presence of precipitating event determine the progression of uncomplicated thyrotoxicosis into TS. It accounts for 1-2% of hospital admissions for thyrotoxicosis to as high as 10%.[1] In the United States survey, the incidence of TS ranged from 0.57-0.76 cases per 100,000 per year in the normal population, and 4.8-5.6 cases per 100,000 per year in hospitalized patients.[2] On the other hand, a nationwide survey in Japan showed that the incidence of TS was 0.2 cases per 100,000 population per year and 5.4% of hospital-admitted patients with thyrotoxicosis.[3]

The mechanisms underlying the development of TS from uncomplicated hyperthyroidism are not well understood. This can be due to an increased response to thyroid hormone with rapid availability of free hormones and enhanced binding to thyroid hormone receptors.[4-6] A

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study showed that the degree of thyroid hormone level is not directly related to a higher incidence of TS.[5] In contrast, Brooks and Waldstein reported higher free thyroid hormone among patients with TS compared to those with simple thyrotoxicosis.[7] The rapidity with which free hormone levels increase was more important than the absolute levels in determining the clinical presentation that occurs following an insult.[6]

The diagnosis of thyroid storm is based on clinical findings. Thyroid function tests have little value in distinguishing uncomplicated thyrotoxicosis from TS, as there is no definite serum T4 or T3 cutoff that differentiates uncomplicated thyrotoxicosis from TS.[7] Furthermore, there is a significant overlap with other acute medical conditions making a clinical diagnosis quite a challenge. More objective methods have been worked on to provide prompt and accurate diagnosis of TS. Burch and Wartofsky in 1993 provided a diagnostic point scale to distinguish uncomplicated thyrotoxicosis from impending or established TS. The Burch-Wartofsky Point Scale (BWPS) considered the continuum of end-organ dysfunction, high variability of individual patient presentation, and the high mortality associated with missed diagnosis with TS.

Points were assigned for dysfunction of the thermoregulatory, central nervous, gastrointestinal-hepatic, and cardiovascular systems. A total score of ≥ 45 is highly suggestive of TS, 25 to 44 supports the diagnosis, and < 25 makes the diagnosis unlikely.[8] The Japanese Thyroid Association (JTA) system is based on similar clinical findings except that thyrotoxicosis is a prerequisite for diagnosis and there is no scoring system.[3] There are two grades of severity for TS in the JTA system: definite TS (TS1) and suspected TS (TS2). Data comparing BWPS and JTA classification showed a tendency toward underdiagnosis with use of the JTA categories of TS1 and TS2 as compared to a BWPS score ≥ 45. A BWPS score ≥ 45 appeared to be more sensitive than the JTA classification of TS1 or TS2 in detecting patients with a clinical diagnosis of TS.[9]

Time and knowledge are critical factors in deciding appropriate management which could otherwise result in loss of life. Treatment is initiated without delay to reduce mortality and started without waiting for the lab results. Thyroid storm is a rare and fatal real medical emergency if left untreated. It continues to have an associated mortality ranging between 10–30%.[1]

There is paucity of literature available on TS in the Philippines. Due to the rarity of TS, its diagnosis becomes challenging, is often misdiagnosed, and causes delays in the diagnosis and management. As the twenty-first century evolved, fellowship in Endocrinology was established in different medical centers throughout the country. Nationwide Thyroid Awareness Week was held to disseminate information about thyroid diseases with screening for thyroid disorders.

Thus, we would like to update our current understanding of TS diagnosis and management. We aim to describe the clinical profile, precipitants, and outcomes of patients with TS seen at the University of Santo Tomas Hospital (USTH) using the BWPS during a 10-year period. Subsequently, we would like to assess the risk factors and hospital outcomes such as in-patient mortality, hospital and intensive care unit length of stay, intubation, and ventilator duration and to investigate the association of patient characteristics, comorbidities, and treatment with mortality.

Methods

Study Design and Population This is a retrospective cohort analysis of subjects admitted to a single tertiary academic hospital, the University of Santo Tomas Hospital (USTH). Medical records of all patients who were admitted from 2009-2018 with a diagnosis of TS or impending TS based on the BWPS were systematically reviewed. The primary investigator of the study conducted the chart review of all the patients. She used a standardized data collection sheet to enhance data collection. Repeated admissions by a single patient were recorded separately. All patient information remained anonymous and kept confidential. Inclusion criteria were adults ≥18 years old who were admitted to USTH from 2009-2018 and were clinically assessed to be in impending TS or TS with a BWPS of 25 or more. Exclusion criteria were patients <18 years old, known pregnancy, with a BWPS of < 25, and with incomplete or inadequate medical data.

Outcome Measures. In-patient mortality, hospital and intensive care unit length of stay, intubation, and ventilator duration were assessed.

Ethical Considerations. This study was carried out in accordance with the Declaration of Helsinki, Good Clinical Practice and the National Ethical Guidelines for Health and Health Related Research 2017. This study was approved by the UST Hospital Institutional Review Board (IRB) and Ethics Committee.

Statistical Analysis. The variation in clinical manifestations among patients with TS were analyzed by the analysis of variance or the chi-squared test, as appropriate. To identify the factors independently associated with clinical outcomes, logistic regression analysis or multiple regression analysis with the stepwise method was used as appropriate after the possible relevant factors had been selected by simple regression analysis. The clinical outcomes that were evaluated were death, irreversible complications, and severity of thyroid crisis. Two-sided $p<0.05$ was regarded as being statistically significant. Statistical analyses were performed using STATA Statistical Software, Version 13, College Station, TX: Stata Corp LP. A $p\text{-value} \leq 0.05$ was considered as statistically significant. Descriptive statistics included mean, standard deviation, frequency, percentage, median, and interquartile range and were used to summarize the outcome measures of the study. Comparative analyses were conducted using *chi-square test* of homogeneity or *Fisher's exact test*, if the observed frequencies were less than 5.00, and independent *t*-test. Univariate binary

Table I. Demographic Profile of Patients with Thyroid Storm According to Treatment Outcomes

Characteristics[a]	Total (n = 21)	Treatment Outcomes		Test Statistic[b] (*p*-value)
		In-Hospital Mortality (n = 3)	Alive (n = 18)	
Age (Years) ($\bar{x}$, SD)	42.90 (16.87)	50.67 (9.07)	41.61 (17.68)	–0.86 (0.403)
Less than 20 Years Old	0 (0.00%)	0 (0.00%)	0 (0.00%)	5.69 (0.098)
20 – 39 Years Old	11 (52.38%)	0 (0.00%)	11 (61.11%)	
40 – 59 Years Old	8 (38.10%)	3 (100.00%)	5 (27.78%)	
60 – 79 Years Old	2 (9.52%)	0 (0.00%)	2 (11.11%)	
≥80 Years Old	0 (0.00%)	0 (0.00%)	0 (0.00%)	
Sex (*f*, %)				2.30 (0.271)
Female	19 (90.48%)	2 (6.67%)	17 (94.44%)	
Male	2 (9.52%)	1 (33.33%)	1 (5.56%)	
Etiology of Thyrotoxicosis (*f*, %)				0.37 (1.000)
Graves' Disease	19 (90.48%)	3 (100.00%)	16 (88.89%)	
Multinodular Toxic Goiter	2 (9.52%)	0 (0.00%)	2 (11.11%)	
Diagnosis of Thyroid Disorder (*f*, %)				6.30 (0.143)
New Presentation	1 (4.76%)	1 (33.33%)	0 (0.00%)	
Known Diagnosis	20 (95.24%)	2 (66.67%)	18 (100.00%)	
Co-Morbidities (*f*, %)				
Hypertension	4 (19.05%)	3 (16.67%)	1 (33.33%)	0.46 (0.489)
Thyrotoxic Heart Disease	5 (23.81%)	1 (33.33%)	4 (22.22%)	0.18 (1.000)
Heart Failure	2 (9.52%)	1 (33.33%)	1 (5.56%)	2.30 (0.271)
Hepatitis	1 (4.76%)	1 (33.33%)	0 (0.00%)	6.30 (0.143)
Asthma	1 (4.76%)	0 (0.00%)	1 (5.56%)	0.18 (1.000)
Burch-Wartofsky Score ($\bar{x}$, SD)	49.52 (16.35)	61.67 (5.77)	47.50 (16.74)	–1.42 (0.170)

[a]*Summary statistics are presented as frequency (percentage) in general unless otherwise indicated.*
[b]*Test statistic involved Chi-Square Test of Homogeneity, Fisher's Exact Test, or independent t-test.*

logistic regression was employed to determine the significant predictors of mortality.

Results

A total of 22 patients were admitted and diagnosed with impending or established TS during the 10-year study period. Twenty-two charts were retrieved. One patient was excluded from the study due to known pregnancy. Twenty-one patients fulfilled the inclusion criteria and were included in the study. Of these, seven patients were in impending TS and 14 patients were in TS. There was one readmission. Only one patient was admitted to the ICU. Twenty patients were admitted at the regular medical ward after initial treatment in the emergency room. The main cause of thyrotoxicosis was Graves' disease (90.48%). The mean age of the patients was 42.90 years old (± 16.87), and older age for those who expired, 50.67 years old (± 9.07). Majority of the patients were female (90.48%), with known diagnosis of hyperthyroidism (95.24%), and 23.81% had thyrotoxic heart disease as a comorbidity. Graves' disease was the most common etiology for those who expired (100.00%). The overall mean BWPS was 49.52 (± 16.35%), with those who had mortality having a higher score of 61.67 (5.77%) and those who are alive had a mean score of 47.50 (16.74%) (*Table I*).

The most frequent reason for seeking consult among patients was fever, which was present in 23.81% of patients. This was followed by difficulty of breathing (19.05%) and chills (14.29%) (*Table II*).

The clinical profile of the patients according to treatment outcomes showed that 38.10% of the patients had fever, 23.81% had CNS dysfunction, 80.95% had tachycardia, 47.62% had atrial fibrillation, 23.81% had congestive heart failure, and 42.86% had hepatic dysfunction (*Table III*).

Comparison of the proportion of patients who had these disorders indicated that these proportions were not statistically different among those who developed mortality and those who did not ($p>0.05$). On the other hand, results showed that the most common precipitating factor was infection (52.38%) followed by irregular use or discontinuation of anti-thyroid drugs

Table II. Chief Complaint of the Patients

Chief complaint	No. of patients (%)
Fever	5 (23.81%)
Difficulty of breathing	4 (19.05%)
Chills	3 (14.29%)
Generalized weakness	2 (9.52%)
Chest pain	2 (9.52%)
Palpitations	1 (4.76%)
Abdominal pain	1 (4.76%)
Jaundice	1 (4.76%)
Others	
Insomnia	1 (4.76%)
Dizziness	2 (9.52%)
Left eye pain	1 (4.76%)

Table III. Clinical Profile of Patients with Thyroid Storm According to Treatment Outcomes

Characteristics	Total (n = 21)	Treatment Outcomes		χ^2-value (*p*-value)
		In-Hospital Mortality (n = 3)	Alive (n = 18)	
Fever (≥38.0°C) (*f*, %)	8 (38.10%)	1 (33.33%)	7 (38.89%)	0.03 (0.684)
CNS Dysfunction (*f*, %)	5 (23.81%)	1 (33.33%)	4 (22.22%)	0.18 (0.579)
Tachycardia (HR>100bpm) (*f*, %)	17 (80.95%)	2 (66.67%)	15 (83.33%)	0.46 (0.489)
Atrial Fibrillation (*f*, %)	10 (47.62%)	1 (33.33%)	9 (50.00%)	0.29 (0.538)
Congestive Heart Failure (*f*, %)	5 (23.81%)	1 (33.33%)	4 (22.22%)	0.18 (0.579)
Gastrointestinal-Hepatic Dysfunction (*f*, %)	9 (42.86%)	1 (33.33%)	8 (44.44%)	0.13 (1.000)
Diarrhea	6 (28.57%)	0 (0.00%)	3 (16.67%)	0.04 (1.000)
Jaundice	3 (14.29%)	1 (33.33%)	5 (27.78%)	0.58 (1.000)
Precipitating Events (*f*, %)				
Irregular Use or Discontinuation of Anti-Thyroid Drugs	4 (19.05%)	1 (33.33%)	3 (16.67%)	0.46 (0.489)
Infection	11 (52.38%)	2 (66.67%)	9 (50.00%)	0.29 (0.538)
Ischemic Heart Disease	3 (14.29%)	0 (0.00%)	2 (16.67%)	0.58 (0.614)
Others	1 (4.76%)	0 (0.00%)	1 (5.56%)	0.18 (0.857)
None	3 (14.29%)	1 (33.33%)	2 (11.11%)	1.04 (0.386)

**Significant at 0.05*
†Significant at 0.01

Table IV. Univariate Binary Logistic Regression Analysis of the Influence of Age, Clinical Manifestations and Burch Wartofsky score on the Development of Mortality as a Treatment Outcome

Predictors	Treatment Outcome (Mortality)			
	Odds Ratio	Standard Error	*p*-value (Two-tailed)	R^2
Age (Years)	1.03	0.04	0.391	0.042
Fever (≥38.0°C)	–1.26	1.04	0.855	0.002
CNS Dysfunction	1.75	2.36	0.678	0.010
Tachycardia (HR>100bpm)	–3.16	0.55	0.506	0.024
Atrial Fibrillation	–2.00	0.66	0.597	0.017
Congestive Heart Failure	1.75	2.36	0.678	0.010
Gastrointestinal-Hepatic Dysfunction	1.30	1.73	0.844	0.002
Precipitating Events				
Irregular Use or Discontinuation of Anti-Thyroid Drugs	2.50	3.45	0.506	0.024
Infection	2.00	2.62	0.597	0.017
Burch-Wartofsky Score	1.06	0.05	0.187	0.112

**Significant at 0.05*
†Significant at 0.01

(19.05%). The most common infection was pneumonia (63.64%). The other types of infection were urinary tract infection, gastroenteritis, and upper respiratory tract infection. Results also revealed that the comparison of the proportion of the precipitating factors was not statistically different between those who developed mortality and those who did not (*p>0.05*).

Mortality was 14.29% while 85.71% of the patients survived and were discharged. Among the patients, 9.52% were intubated, all of whom eventually expired. Results also indicated that the median days of hospital stay was four days, with an interquartile range (IQR) of 3 – 6 days. From the total three mortality, the most common cause of mortality was multiple organ dysfunction with a proportion of 66.67%. The other cause of mortality among the patients was fatal tachyarrhythmia, with a proportion of 33.33%. The univariate binary logistic regression analysis, of the influence of age, clinical profile, precipitating factors, and BWPS are illustrated in *Table IV*.

Results showed that age in years did not significantly predict the likelihood of mortality (OR=1.03, *p=0.391*). Among the different clinical profiles, results indicated that having fever (OR=–1.26, *p=0.855*), CNS dysfunction (OR=1.75, *p=0.678*), tachycardia (OR=–3.16, *p=0.506*), atrial fibrillation (OR=–2.00, *p=0.597*), congestive heart failure (OR=1.75, *p=0.678*), and hepatic dysfunction (OR=1.30, *p=0.844*) did not significantly predict the odds

Table V. Comparison of Characteristics of Patients in Thyroid Storm

	This paper (2025)	Borlongan et al (1995)	Torres et al (1998)	Cauton-valera et al (2003)
Type of study	Retrospective	Retrospective	Retrospective	Retrospective
Period of study	2009-2018	1984-1993	1994-1997	1996-2000
Duration (years)	10	10	4	5
No. Of cases of storm	21	37	36	71
Age range in years (mean)	22-79 (42.9)	19-62 (35.5)	(36)	18-68 (39.8)
Male: female ratio	1:10.5	1:3.5	1:8	1:7
Readmissions	1	1	N/A	4
Impending thyroid storm	7	9	N/A	10
Established	14	27	26	61
Dtg/graves' disease as etiology of thyrotoxicosis	90.48%	88.8%	88.5%	94.4%
Precipitating factor				
Infection	52.38%	55%	23%	78.9%
None identified	14.29%	33%	N/A	14.1%
Febrile	38.1%	78%	N/A	57.7%
Cns dysfunction	23.81%	52.7%	N/A	38%
Tachycardia	80.95%	94%	N/A	87.3%
Heart failure	23.81%	50%	N/A	49.3%
Atrial fibrillation	47.62%	50%	N/A	64.8%
Jaundice	14.29%	22%	N/A	46.5%
Mortalities	3 (14.29%)	5 (14%)	1 (3.85%)	8 (11%)

of developing mortality. Similarly, irregular use or discontinuation of anti-thyroid medication (OR=2.50, *p=0.506*), and infection (OR=2.00, *p=0.597*) did not significantly affect the likelihood of developing mortality. Results also showed that the BWPS did not significantly affect the development of mortality (OR=1.06, *p*=0).

Discussion

Thyroid storm is indeed a rare disease, as our current study had only 21 cases in a decade. Our study showed that most of our patients with TS had pre-existing thyroid disease, specifically Graves' disease. On admission, all were admitted to the wards after initial diagnosis and aggressive treatment in the emergency room, and only one was admitted to the intensive care unit. That it is life-threatening was confirmed in our study with our mortality rate of 14.29%, like the overall associated mortality of TS ranging between 10–30%.[1] The most common cause of mortality was multiple organ dysfunction. The JTA diagnostic criteria and the JTA guidelines for TS were published in 2012 and 2016, respectively, which explains why BWPS was used in making the diagnosis in our study. To the best of our knowledge, this study is the latest local analysis of TS in the 21st century.

Most information on its diagnosis and treatment is derived from small retrospective cohorts or case reports. Review of local literature yielded four local retrospective studies of patients with TS published over time during the twentieth century from 1984 (6 years duration), 1995 (10 years duration), 1998 (4 years duration)[12] and 2000 (5 years duration).[10-13] Highlights of these four local studies were the following: majority of the patients were females, with a comparable mean age with most patients in the fourth decade; TS occurred regardless of the duration of the thyrotoxicosis; diffuse toxic goiter or Graves' disease was the most common etiology for the hyperthyroidism that has been incompletely treated or has not been treated at all; and infection was the most common precipitating event in all four studies, with mortality rates of 30.7%, 14%, 3.85%, and 11%, respectively (*Table V*).

The most common etiology of thyrotoxicosis in this study was Graves' disease, occurring in 90.48 % of patients, but can occur with toxic multinodular goiter and toxic adenoma of the thyroid. This contrasts with the past local studies done, which showed diffuse toxic goiter as the most common etiology of thyrotoxicosis, not necessarily Graves' disease but may have various non-autoimmune causative processes.

Infection was the most frequent precipitating factor seen in our study, in agreement with other studies, but no definite precipitating factor was identified in 15% of patients. Other precipitating events in this study were irregular use or discontinuation of anti-thyroid drugs and ischemic heart disease. Recognition of the precipitating factor when present is essential as this must be addressed for the resolution of thyrotoxic crisis.[6]

TS usually presents with fever. The increased thermogenesis is brought about by the amplified beta-adrenergic response, increased turnover of amino acid and fatty acid pools, and the intensified plasma membrane sodium-potassium exchange via Na-K-ATPase.[6] Fever is not a common manifestation in this study as compared to the local studies done in UP-PGH.[11,12] CNS manifestations range from agitation, delirium, and confusion to stupor, obtundation, and coma. CNS decompensation was present in 23.81% of patients. Thyroid hormones affect both the heart and peripheral vasculature. They cause decreased systemic

vascular resistance and increased resting heart rate, left ventricular contractility and blood volume.[14] Sinus tachycardia, which is the most common rhythm disturbance in patients with hyperthyroidism, is manifested in 80% of our patients. Atrial fibrillation, which is most commonly identified with thyrotoxicosis,[14] occurred in almost half of the patients in our study. In addition, five patients had congestive heart failure. Patients with TS may also have gastrointestinal symptoms which include nausea, profuse vomiting, and severe diarrhea which can contribute to significant ongoing volume depletion. Liver dysfunction and hepatomegaly secondary to hepatic congestion, hypoperfusion, or direct effect from the hyperthyroidism are also reported. In TS, the blood flow in the splanchnic circulation is not increased thereby leading to decrease in hepatic oxygen levels. This results in liver necrosis and jaundice, which is commonly observed in severely thyrotoxic patients.[11] Overall, progression to jaundice is a poor prognostic indicator.[15] In this study, diarrhea was the most common gastrointestinal disturbance. In contrast to the study done by Borlongan et al, the presence of GI disturbances and jaundice were not associated with increased mortality in this study.

A multimodality treatment strategy is necessary for TS management. The treatment approach consists of specific therapy namely: beta-adrenergic blockade (control increased adrenergic tone), anti-thyroid drug therapy (reduce thyroid hormone synthesis), inorganic iodide (reduce the release of thyroid hormone), corticosteroid therapy (block peripheral conversion of T4 to T3), supportive measures like intravenous fluids for fluid resuscitation, cooling blankets, acetaminophen as well as nutritional support and respiratory care, and treatment of the precipitating event or intercurrent illness.[9]

Patients with TS must be admitted to the intensive care unit with close cardiac monitoring and ventilatory support if needed. Either a loading dose of Propylthiouracil (PTU) 500 mg to 1000 mg followed by 250 mg every 4 hours or Methimazole (MMI) 20 mg every 4 to 6 hours should be given. Propylthiouracil is preferred because of its additional effect of blocking the peripheral conversion of T4 to T3. In the first 24 hours of treatment, PTU decreases T3 level by 45% while MMI decreases T3 by only 10% to 15%. Nonetheless, MMI causes more rapid normalization of serum T3 level after a few weeks of treatment and it is less hepatotoxic compared to PTU. Hence, after initial stabilization, PTU should be changed to MMI.[9]

Blocking the peripheral effects of circulating thyroid hormone is integral in the management of TS. Propranolol 40 mg to 80 mg is given every 4 to 6 hours. A cardio-selective beta-blocker like atenolol or metoprolol should be an alternative for patients with reactive airway disease. If there is a contraindication for the use of beta-blockers, diltiazem is an alternative. Esmolol, a short-acting beta-blocker, at a loading dose of 250 to 500 mcg/kg followed by 50 to 100 mcg/kg/minute can be given in the ICU setting.[1] Corticosteroids have been demonstrated to enhance TS patient outcomes by blocking the peripheral conversion of T4 into T3. Hydrocortisone 300 mg intravenous load then 100 mg every 8 hours is given.[9] In patients who do not respond well to conventional therapeutic approaches, TS may be treated with plasmapheresis/plasma exchange and emergency surgery.[9]

A high index of suspicion is needed to detect TS to prevent mortality. If left untreated, TS can lead to fatal arrythmias, atrial fibrillation, thromboembolism, heart failure, seizures, coma, jaundice, abdominal cramps, and diarrhea. Without treatment, mortality in patients with TS ranges from 80-100%. However, even with the recommended therapy, mortality can still reach up to 50%.[16] It is noteworthy that there was decreasing mortality rate seen in patients with TS. Although it is prudent to err on the side of over diagnosing TS to ensure that appropriate treatment is given, aggressive therapy has its adverse outcomes.[8] High doses of thionamides have the potential to cause adverse drug reactions, such as hepatotoxicity, and ß-receptor antagonists have the potential to exacerbate cardiovascular decompensation. Therefore, it is important to carefully consider the potential risks of unnecessary TS treatment.[8]

For the past 10 years, there has been an increased awareness of thyroid disorders in both patients and physicians. This was achieved through educational conferences and webinars for training residents and physicians as well as ongoing advocacies for patients with thyroid disorders. This probably explains the drop in the number of TS cases in our locality from 70 cases in four years to only 21 cases. The median days of hospital stay was four days, with an IQR of 3 – 6 days. In addition, two patients in the study required intubation and both expired eventually.

The most common cause of mortality in the study was multiple organ dysfunction. Using univariate binary logistic regression analysis, age, high BWPS on admission, clinical manifestation and precipitating event did not predict the occurrence of mortality in this study. This is most probably because of the very small number of mortalities in this study. This is in contrast with the research done by Ono et al. which showed that in-hospital mortality was significantly associated with older age (> 60 years), CNS decompensation and requirement for mechanical ventilation.[17]

The predictive features of TS are still not thoroughly identified due to its rarity. One study found no clinical predictors for mortality, which is similar in the present study.[12] It shows that clinical predictors for mortality in patients with TS are still to be understood. In fact, it was the conclusion in one study that mortality depends on the complications rather than the clinical characteristics of the

patients.[2] Earlier diagnosis, aggressive volume resuscitation to replace fluid losses, early institution of ß-receptor antagonists and thionamides as mainstay of treatment as well as intravenous steroids and SSKI as adjuncts to treatment are contributory factors in the decline in mortality rate.

Conclusion

Prevalence of TS in the 21st century is rare. Mortality depends on the complications rather than the clinical characteristics of the patients. Its non-specific manifestations often overlap with other illnesses making it both a diagnostic and therapeutic challenge. More frequent screening for thyroid disorders may lead to earlier diagnosis of hyperthyroidism and improved prevention of TS. Prompt recognition, early diagnosis and treatment can improve outcome in these patients.

Limitations of the Study

Being a retrospective study, this study is limited by the chart retrieval rate as well as the available information written on the patient's records. In addition, this study was limited to a single tertiary care institution hence the sample size was relatively small. The small sample size could explain the lack of statistical power to account for the findings.

Strength

The study was done in a tertiary teaching hospital setting.

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Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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