



High Scored Thyroid Storm after Stomach Cancer Perforation: A Case Report and Review of the Literature

Seung Min Baik^{1,2}, Yejune Pae³ and Jae-Myeong Lee^{4*}

¹Department of Critical Care Medicine & Surgery, Ewha Womans University Mokdong Hospital, Republic of Korea

²Department of Surgery, College of Medicine, Graduate School of Korea University, Republic of Korea

³Korea University College of Medicine, Republic of Korea

⁴Department of Surgery, Division of Acute Care Surgery, Korea University Anam Hospital; University College of Medicine, Republic of Korea

Abstract

Thyroid storm is a life-threatening emergency. Reportedly, the prevalence of thyroid storm is 1% to 2% among patients admitted to the hospital for thyrotoxicosis. Burch and Wartofsky (1993) introduced a scoring system using precise clinical criteria to identify thyroid storms. Only 17 cases of thyroid storm with a score >70 points have been reported. Although thyroid storms are uncommon, their clinical findings resemble those of sepsis. A 48-year-old man was referred to the emergency room from a local clinic owing to suspicion of gastric ulcer perforation; medications for hypertension, diabetes mellitus, and hyperthyroidism had been suspended 1 year prior to this visit. We performed an emergency distal gastrectomy with Billroth II anastomosis for gastric cardia cancer perforation, and the patient was referred to the surgical Intensive Care Unit (ICU). On the 2nd day in the ICU, his Body Temperature (BT) increased to 41.3°C at 19:00, with the thyroid storm score peaking at 18:00 (BT; 41.2°C, Pulse Rate [PR]; 138/min, irritable status). The patient was administered propylthiouracil, intravenous glucocorticoids, acetaminophen, and Lugol's solution daily. Subsequently, we performed bladder irrigation with cold saline using a Foley catheter and applied a hypothermic blanket to decrease the patient's BT. His vital signs were stable on the 8th day in the ICU. Thyroid storms are uncommon, with few reports in the literature; however, their clinical findings resemble those of sepsis and require further investigation. Since an untreated thyroid storm results in a high mortality rate, it should be investigated when managing sepsis.

Keywords: Thyroid storm; Stomach cancer; Severity score

Introduction

Thyroid storm is a life-threatening emergency. Reportedly, the prevalence of thyroid storm 1% to 2% among patients admitted to the hospital for thyrotoxicosis [1]. In a nationwide survey of hospitals in Japan, the incidence of thyroid storm in hospitalized patients was 0.22% among all patients with thyrotoxicosis and 5.4% of patients admitted to the hospital for thyrotoxicosis [2,3]. Thyroid storm can develop in patients with long-standing untreated hyperthyroidism and can be precipitated by an acute event such as thyroid or non-thyroidal surgery, trauma, infection, an acute iodine load, or parturition [4]. Recent data suggest that the mortality rate of thyroid storms is approximately 10% to 30% [1,2]. Multiple organ failure is the most common cause of death, followed by congestive heart failure, respiratory failure, arrhythmia, disseminated intravascular coagulation, gastrointestinal perforation, hypoxic brain syndrome, and sepsis [2,3]. Thyroid storm is diagnosed by clinical findings. Burch and Wartofsky (1993) introduced a scoring system using precise clinical criteria for the identification of thyroid storms (Table 1) [5]. Based on these criteria, a score of <25 points indicates that a thyroid storm is unlikely; 25 to 44 points an impending thyroid storm; and ≥ 45 points, thyroid storm. There is no concept of a "severe" thyroid storm. However, to the best of our knowledge, only 17 cases of thyroid storm with a score >70 points have been reported. Among these 17 cases, only four cases had a score of 90 points. Although thyroid storms are uncommon, their clinical findings resemble those of sepsis. Here, we report a case of thyroid storm with a score of 90 points after gastric perforation surgery, and we analyze the "severe" form of thyroid storm (with a score >70 points) in the 17 cases reported in the literature.

Case Presentation

A 48-year-old male patient was referred to the Emergency Room (ER) from a local clinic owing

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*Correspondence:

Jae-Myeong Lee, Department of Surgery, Division of Acute Care Surgery, Korea University Anam Hospital; Korea University College of Medicine, Goryeodae-ro 73, Seongbuk-gu, Seoul 02841, Republic of Korea, Tel: +82-2-920-5948; Fax: +82-2-928-1631;

E-mail: ljm3225@hanmail.net

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Table 1: Diagnostic and severity scoring criteria for thyroid storm adapted from: Burch HB, Wartofsky L. Life-threatening thyrotoxicosis. Thyroid storm. Endocrinol Metab Clin North Am 1993;22:263.

Thermoregulatory dysfunction	
Temperature (°C)	
37.2 to 37.7	5
37.8 to 38.2	10
38.3 to 38.8	15
38.9 to 39.4	20
39.4 to 39.9	25
≥ 40	30
Central nervous system effect	
Mild	10
Agitation	
Moderate	20
Delirium	
Psychosis	
Extreme lethargy	
Severe	30
Seizure	
Coma	
GI-hepatic dysfunction	
Moderate	10
Diarrhea	
Nausea/vomiting	
Abdominal pain	
Severe	20
Unexplained jaundice	
Cardiovascular dysfunction	
Tachycardia	
99 to 109	5
110 to 119	10
120 to 129	15
130 to 139	20
≥ 140	25
Atrial fibrillation	10
Heart failure	
Mild	5
Pedal edema	
Moderate	10
Bibasilar rales	
Severe	15
Pulmonary edema	
Precipitant history	
Negative	0
Positive	10
Thermoregulatory dysfunction	
Temperature (°C)	
37.2 to 37.7	5
37.8 to 38.2	10
38.3 to 38.8	15
38.9 to 39.4	20
39.4 to 39.9	25
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Central nervous system effect	
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Seizure	
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Cardiovascular dysfunction	
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Atrial fibrillation	10
Heart failure	
Mild	5
Pedal edema	
Moderate	10
Bibasilar rales	
Severe	15
Pulmonary edema	
Precipitant history	
Negative	0
Positive	10

to suspicion of gastric ulcer perforation. He had a medical history of hypertension, type II Diabetes Mellitus (DM), and hyperthyroidism. One year ago, he had stopped taking medications for hypertension, DM, and hyperthyroidism.

In the ER, he complained of nausea, diffuse abdominal pain, general weakness, anorexia, and indigestion, which had started 4 days prior to admission. On physical examination, he presented with hypoactive bowel sounds and direct tenderness in the epigastric area. His vital signs were as follows: Blood pressure (systolic blood pressure/diastolic blood pressure) 140/80 mmHg, Body Temperature (BT) 37.1°C, Pulse Rate (PR) 120/min, respiratory rate 18/min, and peripheral capillary Oxygen Saturation (SpO₂) 100%. Laboratory examination showed the following results: White blood cell counts 12.5 × 10³/μL, erythrocyte sedimentation rate 38 mm/h, and C-reactive protein 16.93 mg/dL. Computed tomography in the ER revealed peritonitis due to gastric ulcer perforation and gastric malignancy with suspected peritoneal carcinomatosis. The results of thyroid function tests are shown in Table 2. The free T4, T3, and T4 levels exceeded the normal range, while thyroid stimulating hormone levels were below the normal range. The other laboratory results were non-specific. Oral propylthiouracil (PTU; 800 mg) was administered to the patient for preoperative treatment. We performed an emergent distal gastrectomy with Billroth II anastomosis for gastric cardia cancer perforation, a palliative surgery performed owing to peritoneal tumor seeding. The total operating time was 3 h and 55 min, and the patient's vital signs were stable during surgery. Postoperatively, the patient was referred to the surgical Intensive Care Unit (ICU), and his vital signs were checked every hour. On the 2nd day in the ICU, the patient's BT increased to 41.3°C at 19:00, and the thyroid storm score peaked at 18:00 (BT 41.2°C; PR 138/min); furthermore, he was irritable; had a Glasgow Coma Scale score of E3V1M5, with eye opening to speech, no verbal response, and localized motor response

Table 2: Thyroid function test values of the patient.

Hormone (normal range, unit)	At ER (preoperation)	Postop. day #6	Postop. day # 11
T3 (60.0-181.0, ng/dL)	625.4	79.9	94.1
T4 (4.50-10.90, ng/dL)	27.27	5.80	12.45
fT4 (0.89-1.76, ng/dL)	7.02	1.90	3.58
TSH (0.55-4.78, uIU/mL)	<0.008	<0.008	<0.008

ER: Emergency Room; Postop: Postoperative; T3: Triiodothyronine; T4: Thyroxine; fT4: free Thyroxine; TSH: Thyroid-Stimulating Hormone

to pain; and complained of severe pain (Table 3). The patient was administered a daily dose of oral PTU 800 mg, PTU enema 400 mg, intravenous glucocorticoids 40 mg, oral acetaminophen 650 mg, and oral Lugol’s solution 1.5 mL. Subsequently, we performed bladder irrigation with cold saline using a Foley catheter and applied a hypothermic blanket to decrease the patient’s BT. On the 3rd day in the ICU, the PTU dose was increased to 1,200 mg/day, while the doses of the other drugs were maintained. From the 4th day, the oral PTU dose was fixed at 200 mg, q6hd; Lugol’s solution (0.5 mL; q8hd) was also delivered. On the 9th day, the patient was referred to the general ward, with the administration of oral PTU 200 mg four times daily and tapering of glucocorticoid therapy. The patient’s vital signs were stable from the 8th postoperative day, and he showed clear mental status on the 4th postoperative day (Figure 1). In the general ward, on the 15th day, the oral PTU dose was decreased to 200 mg three times daily. On the 29th hospital day, he was discharged with an asymptomatic status, stable vital signs, and a prescribed dose of oral PTU 200 mg three times daily.

Discussion and Conclusion

We report a case of thyroid storm with extremely high fever (41.3°C), typically associated with patient mortality. Indeed, high fever alone increases mortality in ICU patients [6]. While this patient’s BT was <40°C in the ER, it increased to >40°C postoperatively. Later, the

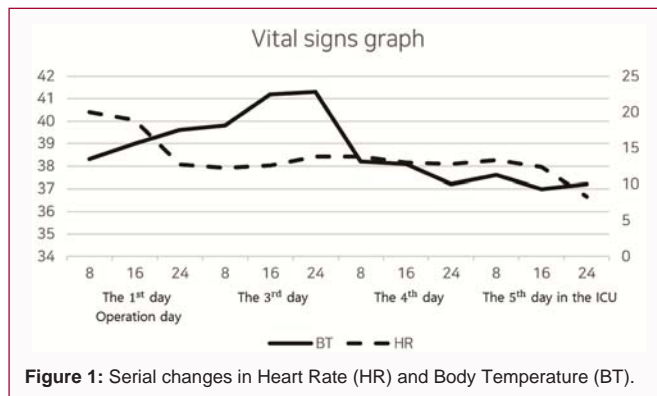


Figure 1: Serial changes in Heart Rate (HR) and Body Temperature (BT).

patient presented with tachycardia (peaked at 138/min), irritability, and abdominal pain; he also had a history of hyperthyroidism, with a high score of 90 points in the thyroid storm scoring system, which reflects disease severity. Based on the scoring system, thyroid storms are considered unlikely for scores of <25 points, while 25 to 45 points suggest impending storms; a score of >45 points is highly associated with thyroid storms (Table 1). Therefore, when the score approaches 45 points, the patient needs more intensive monitoring and re-evaluation for thyroid storm. The mortality risk associated with thyroid storm is estimated to be 8% to 25%, despite modern advancements in treatment and supportive measures [7].

In this case, the extremely high BT (41.3°C), elevated PR (138/min), and altered Glasgow Coma Scale score (E3V1M5) observed on the 2nd day in the ICU were immediately considered to indicate thyroid storm, and treatment was initiated. Severity was assessed at the same time as the diagnosis using the scoring system. The patient was diagnosed with gastric ulcer perforation. Therefore, these symptoms may be considered as signs of sepsis. To the best of our knowledge, there are some reports of cases with scores of <70 points;

Table 3: Summary severity scores of previously reported thyroid storm cases over 70 points and the present case.

Case No.	Age/Gender	BT	CNS effect	GI-hepatic dysfx.	CV dysfx.	HF	Pre. Hx.	Total	Mortality	Year reported/Reference No.
1	40/Male	20	30	20	35	10	0	115	No	2014 [8]
2	50/Female	0	20	0	35	5	10	90	No	2009 [9]
3	48/Male	10	10	20	25	10	10	85	No	2011 [10]
4	30/Female	15	30	0	25	0	10	80	Yes	1991 [11]
5	43/Male	10	20	10	25	5	10	80	No	2009 [12]
6	62/Female	20	0	10	25	15	0	70	No	2012 [13]
7	55/Female	0	20	10	25	5	10	70	No	2008 [14]
8	56/Female	0	20	20	20	10	0	70	No	2010 [15]
9	50/Male	15	10	10	25	0	10	70	Yes	1992 [16]
10	51/Female	15	10	0	25	15	10	75	No	2018 [17]
11	52/Male	5	20	10	30	10	0	75	No	2018 [18]
12	36/Female	20	10	0	20	15	10	75	No	2017 [19]
13	24/Female	30	10	10	25	0	10	85	No	2016 [20]
14	63/Male	20	10	0	35	5	0	70	No	2020 [21]
15	59/Female	10	20	10	25	0	10	75	No	2011 [22]
16	50/Female	15	20	10	35	10	0	90	No	2013 [23]
17	41/Female	10	10	10	35	15	10	90	No	2012 [24]
18	48/Male	30	10	20	20	0	10	90	No	present case

BT: Body Temperature; CNS: Central Nervous System; GI-hepatic dysfx: Gastrointestinal-Hepatic Dysfunction; CV: Cardiovascular; HF: Heart Failure; Pre.Hx: Precipitant History.

however, there are only 17 reported cases with scores of ≥ 70 points (Table 3) [8-24]. Among the 17 cases with scores of ≥ 70 points, two involved mortality. Case 1 involved the highest severity score, with 115 points. In case 1, the patient had no previous medical or family history of thyroid disease (0 points). Laboratory findings showed liver dysfunction with jaundice (20 points), while physical examination revealed the following: Atrial flutter with a PR of 162/min (35 points), high fever (39.3°C) (20 points), impaired consciousness (30 points), and reduced ejection fraction (43%) with moderate bilateral pleural effusion (10 points). The patient in case 1 was discharged from the hospital on day 94. In the two mortality cases, the severity scores were 80 and 70. In the mortality case with a severity score of 80 points, the central nervous system dysfunction score was very high (30 points). Meanwhile, in the mortality case with a severity score of 70 points, the cardiovascular dysfunction score was 25 points, which was relatively high compared to other scores. However, the total severity scores in the mortality cases were not relatively high compared to those of other thyroid storm cases. In all 18 cases, including our case, no correlation was found between the severity score and mortality; nevertheless, the number of cases is insufficient to draw a valid conclusion. Comparing our case to the other 17 cases reported in the literature, we found that our patient presented with extremely high fever and a high severity score. In cases with the same score (cases 2, 16, 17, and 18 [present case]), the highest-scored factor differed between cases. Meanwhile, cases 2, 16, and 17 had high scores for cardiovascular dysfunction (PR>140/min with atrial fibrillation), and the present case involved a high BT (41.3°C). High fever and tachycardia are the main parameters of systemic inflammatory response syndrome, as per the criteria established in 1991 [25]. In the Sepsis-3 criteria, newly established in 2016, PR and BT were not included [26]. However, in the intensive care unit, these two parameters are still considered important for treatment. In general, thyroid function tests are not performed before emergency surgery for bowel perforation. Tachycardia and high fever are commonly observed postoperatively. However, since thyroid storm is a life-threatening emergency and mortality is high when treatment is delayed, thyroid function evaluation should not be overlooked when managing sepsis.

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