A pain in the neck: *Salmonella* spp. as an unusual cause of a thyroid abscess. A case report and review of the literature

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**Abstract**

**Background:** Thyroid gland infections are rare. Their incidence is estimated to be less than 1% in immunocompromised hosts. Most common pathogens isolated are Gram positive aerobic cocci. Infections with Gram negative facultative aerobes such as *Salmonella* are rare.

**Case presentation:** A 55-year-old female with type II diabetes mellitus and a history of a colloid right thyroid lobe nodule presented with neck pain and fever. She was found to have a thyroid abscess 2 weeks following a non-specific diarrheal illness. A needle aspiration for symptomatic and diagnostic purposes was performed. Cultures grew *Salmonella enterica* serotype Heidelberg. She was treated with a 12-week course of oral antibiotics and serial aspiration.

**Conclusion:** A thyroid abscess is a rare occurrence; however, a high index of suspicion is required to make the diagnosis. The management is directed at minimizing morbidity. The mainstay treatment is medical, but surgery is sometimes necessary to achieve adequate source control, particularly when complications arise.

**Keywords:** Thyroiditis, Thyroid abscess, Salmonella, Suppurative thyroiditis

**Background**

Thyroid infections are a rare entity because of the unique anatomical location and physiological characteristics the gland possesses [1, 2]. Acute Suppurative Thyroiditis (AST) is commonly seen in abnormal thyroid glands. Another predisposing factor for this condition is an immunocompromised state [3]. It is caused by bacterial pathogens, of which Gram-positive aerobes such as *Staphylococcus aureus* and *Streptococcus pyogenes* are the most common isolates [4–6]. Infections with Gram-negative facultative aerobes such as *Salmonella* spp. are rare, which could be life-threatening in immunocompromised patients.

Complications from the infection could range from recurrent laryngeal nerve injury, airway obstruction, sepsis, and death [7–9]. Therefore, prompt diagnosis and proper management can prevent such complications [10]. In this manuscript, we report on a case of a thyroid abscess due to *Salmonella spp.* in an immunocompromised patient. We also provide a retrospective review of all cases of AST due to *Salmonella spp.* reported in the English literature from January 1980 through December 2019 in the MEDLINE, EMBASE, and Scopus databases. The search terms used were thyroid abscess, suppurative thyroiditis, and salmonella.
Case presentation
A 55-year-old woman presented to the emergency department with a chief complaint of acute onset right-sided neck pain that developed over 12–24 h. The pain was continuous and dull in nature, was felt in the right anterior neck, was non-radiating, aggravated by neck rotation, had no relieving factors, and was rated at 10/10 in severity. It was associated with a fever of 39.9 degrees Celsius measured orally, diaphoresis, and chills. She denied having any change in voice or difficulty in breathing or swallowing. Her past medical history included multiple colloid cysts in her right thyroid lobe followed by serial ultrasound (US), as well as other comorbidities such as type II diabetes mellitus (DM), hypertension, hypothyroidism, gastroesophageal reflux disease and dyslipidemia. Of note, she had dental cleaning and a non-specific diarrheal illness for 48 h, 17 days prior to her presentation, respectively. Her past surgical history included a tonsillectomy as a child. Her social history revealed no recent travel, no bird or farm exposure, and no sick family contacts. She denied using any illicit drugs. She had no pets and was a lifelong non-smoker. Her immunization status was up to date. Her medications included spironolactone, irbesartan, sitagliptin, canagliflozin, levothyroxine, aspirin, rosvastatin, rabeprazole, and vortioxetine. She had multiple allergies, including penicillin and sulfa drugs, which caused hives. She also reported a rash with macrolides.

On examination, she appeared well, had no stigmata of endocarditis, and no lymphadenopathy. She did not have a hoarse voice or stridor. Examination of her ears, nose, throat and oral cavity was normal. Flexible nasal endoscopy revealed a normal looking nasopharynx, oropharynx, and hypopharynx, with normal vocal cord mobility. Inspection of her neck showed an asymmetric right-sided prominence, with overlying erythema. There was diffuse tenderness and fullness of the lower right side of the neck. There were no limitations in range of motion of the neck. A complete blood count revealed leukocytosis at 20.8 × 10^9/L with a predominance of neutrophils. Blood culture and urinalysis were unremarkable. Thyroid stimulating hormone (TSH) level was 0.77 mIU/L and Hemoglobin A1c (HbA1c) was 7.8%. A contrast-enhanced computed tomography (CT) scan of the neck demonstrated a large cystic lesion in the right thyroid lobe that measured 6.1 × 4.4 × 4.6 cm (cm) (Fig. 1). A correlation made with a prior surveillance US done 7 months earlier showing an increase from 4.9 × 2.3 × 4.8 cm (Fig. 2).

Following the CT scan, the patient received a 1 g dose of intravenous (IV) ceftriaxone. An initial attempt at percutaneous drainage was unsuccessful and the patient was discharged on 500 mg of cephalexin orally four times a day. The patient returned to the emergency department 3 days later with worsening symptoms and subjective difficulties in swallowing solids. Another attempt at percutaneous drainage yielded 25 ml (mL) of purulent fluid that was sent for culture. She noticed immediate relief and a significant improvement in her symptoms. She was switched to clindamycin 450 mg

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**Fig. 1** An enhanced CT scan of the neck on initial presentation. a-c showing the axial views from superior to inferior, d-f showing the coronal views from anterior to posterior and f showing the sagittal view. Images are showing a large lobulated cystic lesion with some thin septations, measuring about 6.1 × 4.4 × 4.6 cm in maximal craniocaudal, anterior-posterior, and transverse dimensions, respectively.
orally four times a day and discharged. She was brought back to clinic 3 days later for follow up, where she was found to have recurrent symptoms. Percutaneous aspiration was performed again yielding 20 mL of purulent fluid that was again sent for culture. She noticed immediate symptomatic relief. The Infectious Diseases specialists were consulted and started the patient on ciprofloxacin 500 mg orally twice a day based on the culture results from the first aspirate fluid, which grew *Salmonella enterica* serotype Heidelberg sensitive to ceftriaxone, ciprofloxacin, and trimethoprim-sulfamethoxazole, but resistant to ampicillin.

She presented to the emergency department 4 days later due to recurrent symptoms. A repeat percutaneous aspiration yielded 30 mL of purulent fluid that was once again cultured. No changes were made to her antibiotics as the culture results from both subsequent aspirates were unchanged. Her white cell count dropped to 11.58 × 10⁹/L, and her C-Reactive Protein (CRP) was measured at 223.4 mg/L. After the third percutaneous aspiration, she continued to improve. Her white cell counts a week later had normalized, and her CRP dropped to 16.8 mg/L. A repeat contrast-enhanced CT scan a month after her initial presentation showed regression of the cystic component of the lesion to 3.7 × 4.3 × 5 cm (Fig. 3). However, the lesion had a heterogeneously rim enhancing wall and was multiseptated, with some inflammation involving the infra-hyoid strap and the sternocleidomastoid muscles (Fig. 2). Her inflammatory markers by now had normalized. Given the CT findings, a decision was made to continue with the antibiotic course for an additional 6 weeks. Two weeks following the CT scan, an US-guided aspiration yielded 3 mL of purulent fluid. However, the fluid was sterile on culture. The patient completed a total of 12 weeks on the oral ciprofloxacin and had a complete recovery, remaining symptom free at 1 year post initial presentation. Her only complication of treatment was a vaginal yeast infection, treated successfully with oral fluconazole.

### Discussion and conclusion

The thyroid gland is rarely infected due its protective fibrous capsule, rich vascularity, lymphatic drainage, and high concentration of iodine and hydrogen peroxide inhibiting bacterial growth [1, 5, 11, 12]. The incidence of AST and abscess formation is 0.1–0.7% of all reported thyroid lesions [6]. Abnormal thyroid anatomy, such as nodular goiter, cysts, and pyriform sinus fistulas can predispose to AST [5, 13, 14]. The latter originates from a third or fourth branchial cleft cyst anomaly, and can have tracts that connect the pyriform sinus and thyroid gland. Therefore, a branchial cleft cyst anomaly is a risk factor for recurrent thyroid infections and abscess formation [14]. Our patient did not have a branchial cleft cyst anomaly but was known to have a colloid cyst in the right thyroid lobe. Interestingly, for undetermined reasons, the right lobe is more commonly involved than the left lobe in suppurative thyroiditis [15, 16].

The causative organisms of AST are mainly bacterial with few reports caused by fungi, and parasites [10]. The most common bacteria are Gram-positive aerobes such as *Staphylococcus aureus* and *Streptococcus pyogenes*, which account for 40% of cases [6]. Infections with Gram-negative aerobes account for 25%, while anaerobes account for 12% of AST cases [10]. Our review found 28 previously reported cases of *Salmonella* spp. AST. Previous reports are summarized in Table 1 [1, 2, 5, 7–10, 13–34]. *Salmonella* is a motile Gram-negative anaerobic bacillus with two main species; *S. enterica* and *S. bongori* [35]. However, there are many subspecies of both. *Salmonella* thyroiditis can be caused by typhoidal *salmonella* and non-typhoidal *salmonella* (NTS), with the latter being more common [16]. Common (NTS) serotypes are *Enteriditis, Typhimurium, Newport, Javiana, and Heidelberg* [36]. NTS causes gastroenteritis in immunocompetent patients and is often non-invasive.
However, a major predisposing factor to develop AST is immunocompromised status. Despite this, the incidence of thyroid infections in this population is less than 1% [3–5, 14]. Uncontrolled DM, prolonged use of steroids, Human Immunodeficiency Virus (HIV), cancer, and post-transplantation immune suppression are most commonly implicated in patients with AST secondary to Salmonella spp. and more specifically NTS. In immunocompromised patients, NTS could cause more invasive extra-intestinal infections [35, 37–39]. Our patient’s Hg A1c was elevated at 7.8% indicating suboptimal control of DM that is in keep with most cases of AST with DM in the literature [8, 10, 35].

Extra-intestinal infection by Salmonella occurs by dissemination of the bacteria through the bloodstream or lymphatics [15, 40]. Haematogenous spread occurs from the gastrointestinal (GI) tract, and extra-intestinal infection ensues after distant seeding of the bacteria. Salmonella can also spread through the lymphatic route from the GI tract or tonsils [40]. In the majority of reported cases, a previous episode of gastrointestinal illness, upper respiratory tract infection, or pharyngitis, was implicated prior to the infection in the thyroid gland [1, 7, 10, 15–17, 22, 23, 33]. Hence, we hypothesize in our case that hematogenous spread from the GI tract during the diarrheal illness allowed for seeding of the organism in the pre-existing thyroid nodule. Furthermore, as per Telzak et al., diabetics are more prone to develop salmonella infections due to lower gastric acid production and slowed gastric motility [41].

Fever, chills, neck pain, lethargy, sore throat, and compressive symptoms like dysphagia and voice changes are different presentations of AST [4, 10, 15]. Thyrotoxicosis is a potential complication [9, 18, 25]. It occurs due to the release of thyroid hormones into the circulation when thyroid follicles are disrupted from the infection [14, 33, 42]. This could be detected with thyroid function tests i.e. TSH, triiodothyronine (T3), and thyroxine (T4). Our patient only had her TSH measured as a screen for thyrotoxicosis, which was normal. Potential differential diagnoses to consider for patients presenting with AST symptoms are de Quervain’s thyroiditis, medullary or anaplastic thyroid carcinoma, and subacute thyroiditis as well as other deep space neck infections [4, 16, 33, 42]. Other complications include airway obstruction, destruction of the thyroid or parathyroid glands, internal jugular vein thrombosis, recurrent laryngeal nerve injury, sepsis, and death [5, 7–9, 28]. Thus, prompt diagnosis is crucial. Blood work, imaging, and cultures are helpful in reaching the diagnosis [4, 10, 20, 24]. Blood workup includes complete blood count, inflammatory markers like CRP and erythrocyte sedimentation rate (ESR), and thyroid function tests such as TSH, T3 and
| Case Number | Publication                      | Number of Cases | Age & Gender | Predisposing Comorbidities | Thyroid abnormalities | Salmonella Species | Intervention                                      |
|-------------|----------------------------------|-----------------|--------------|-----------------------------|----------------------|-------------------|-----------------------------------------------|
| 1           | Svenungsson & Lindberg [17]      | 1               | 72 M         | Steroid use                | N/A                  | Salmonella enteriditis | TMP-SMX (duration not specified) None          |
| 2           | Walter and MacMonagle [18]       | 1               | 49 F         | None                        | MNG                  | Salmonella choleraesuis | Amoxicillin (duration not specified) Thyroid lobectomy |
| 3           | Fule and Saoji [19]              | 1               | N/A          | N/A                         | N/A                  | Salmonella paratyphi A | N/A N/A                                       |
| 4           | Nmadu [20]                       | 2               | N/A          | N/A                         | N/A                  | Salmonella typhi     | N/A N/A                                       |
| 5           | Gudipati and Westblom [21]       | 1               | 79 M         | N/A                         | N/A                  | Salmonella typhimurium | Ceftriaxone \times 2 weeks I&D               |
| 6           | Igler, et al. [22]               | 1               | 70 F         | DM                          | MNG                  | Salmonella enteriditis | TMP-SMX \times 4 \text{ weeks} I&D          |
| 7           | Chiovato, et al. [23]            | 1               | 40 F         | None                        | MNG                  | Salmonella Brandenburg | Ceftriaxone \times 10 \text{ days} Aspiration, I&D, and thyroid lobectomy |
| 8           | Lalitha and John [24]            | 2               | N/A          | N/A                         | None                 | Salmonella paratyphi A, Salmonella choleraesuis | None None                                     |
| 9           | Lecuit, et al. [25]              | 1               | 48 M         | HIV infection               | None                 | Salmonella enteriditis | Amoxicillin \times 12 \text{ days} I&D       |
| 10          | Susković and Z Vuckević [26]     | 1               | 47 F         | None                        | None                 | Salmonella enteriditis | Antibiotics (not specified) I&D              |
| 11          | Lala, et al. [27]                | 1               | 66 M         | Thyroid nodule              | Salmonella group D   | Ciprofloxacin (duration not specified) Subtotal thyroidectomy |
| 12          | Jasmi, et al. [14]               | 1               | 62 F         | None                        | MNG                  | Salmonella typhi     | Amoxicillin-clavulenic acid \times 3 \text{ days} Aspiration I&D               |
| 13          | Duraker, et al. [7]              | 1               | 52 M         | DM                          | None                 | Salmonella typhi     | Netilmicin + Clindamycin (duration not specified) I&D               |
|             |                                  |                 |              |                             |                      |                   | Ofloxacin \times 10 \text{ days}            |
| 14          | Su and Huang [16]                | 1               | 79 F         | DM                          | MNG                  | Salmonella typhimurium | Ampicillin (duration not specified) Thyroid lobectomy |
|             |                                  |                 |              |                             |                      |                   | Ceftriaxone \times 17 \text{ days}          |
|             |                                  |                 |              |                             |                      |                   | Ciprofloxacin (duration not specified)       |
| 15          | Dai, et al. [28]                 | 1               | 82 M         | CLL                         | MNG                  | Salmonella group B   | Ceftriaxone (duration not specified) I&D     |
| 16          | Sriburee [29]                    | 1               | 55 F         | None                        | MNG                  | Salmonella group C   | TMP-SMX \times 2 \text{ weeks} Aspiration and I&D |
|             |                                  |                 |              |                             |                      |                   | Cefazolin and metronidazole (duration not specified)       |
| 17          | Chen, et al. [30]                | 1               | 60 F         | Invasive thymoma            | MNG                  | Salmonella group D1  | Ceftriaxone \times 2 \text{ weeks} Thyroid lobectomy |
|             |                                  |                 |              |                             |                      |                   | Oral antibiotics (duration not specified)     |
| 18          | Chou and Hsieh [31]              | 1               | 31 F         | None                        | MNG                  | Salmonella choleraesuis | Amoxicillin/subbactam I&D                     |
|             |                                  |                 |              |                             |                      |                   | Clindamycin and ceftriaxone (duration not specified)       |
| 19          | Krudop, et al. [32]              | 1               | 53 F         | None                        | MNG                  | Salmonella group C   | Antibiotics (duration not specified) I&D and thyroid lobectomy |
|             |                                  |                 |              |                             |                      |                   | Cefepime \times 4 \text{ days,}              |
| 20          | Wu, et al. [1]                   | 1               | 74 M         | Renal transplant on immunosuppressive therapy | None                 | Salmonella enteriditis | Ceftriaxone \times 28 \text{ days} Lifelong antibiotics |

Comment below.
| Case Number | Publication            | Number of Cases | Age & Gender | Predisposing Comorbidities | Thyroid abnormalities | Salmonella Species | Intervention | Medical | Surgical |
|-------------|------------------------|-----------------|--------------|-----------------------------|-----------------------|---------------------|--------------|---------|----------|
| 21          | Ambrożak, et al. [15]  | 1               | 82 M         | DM, and steroid use         | None                  | Salmonella enteritidis | Ceftriaxone × 2 weeks | Thyroid lobectomy |
| 22          | Kiss, et al. [2]       | 1               | 48 F         | HIV infection               | N/A                   | Salmonella spp.      | Ceftriaxone × 2 weeks | I&D      |
| 23          | Kazi, et al. [33]      | 1               | 52 M         | HIV infection               | None                  | Salmonella spp.      | Lifelong TMP-SMX      | Thyroid lobectomy |
| 24          | Kuzu, et al. [9]       | 1               | 50 F         | DM                          | N/A                   | Salmonella enteritidis | Metronidazole and ceftriaxone × 5 days | I&D      |
| 25          | Murali & Bhandary [5]  | 1               | 26 F         | None                        | MNG                   | Salmonella Typhi     | Antibiotics × 1 week (duration not specified) | Thyroid lobectomy |
| 26          | Hernik, et al. [8]     | 1               | 61 F         | DM                          | None                  | Salmonella enterica  | Clindamycin, ceftazidime × 1 week | I&D      |
| 27          | Vengathajalam, et al. [10] | 1           | 58 F         | DM                          | MNG                   | Salmonella spp.      | Antibiotics (not specified) | Aspiration |
| 28          | Quintana, et al. [34]  | 1               | N/A          | None                        | N/A                   | Salmonella enteritidis | Antibiotics (not specified) | None     |

F. Female, M. Male
N/A. Not available or not mentioned in the article, MNG. Multinodular goiter, DM. Diabetes mellitus, HIV. Human Immunodeficiency Virus, CLL. Chronic lymphocytic leukemia, I&D. Incision and drainage, TMP-SMX. Trimethoprim/sulfamethoxazole.
compromised patients have a more virulent clinical course and poorer outcomes, including death. The purpose of management is to minimize morbidity; thus, quick diagnosis and early treatment is crucial. The mainstay treatment is medical, but surgery may be necessary to achieve adequate source control particularly in the presence of complications.

Abbreviations
CT: Computed tomography; US: Ultrasonography; CRP: C-reactive protein; ESR: Erythrocyte sedimentation rate; cm: Centimeters; g: Grams; mg: Milligrams; GI: Gastrointestinal; mL: Milliliters; HgA1c: Hemoglobin A1c; AST: Acute Suppurative Thyroiditis; TSH: Thyroid Stimulating Hormone; T4: Thyroxine; T3: Triiodothyronine; NTS: Non typhoidal salmonella; DM: Diabetes mellitus; HIV: Human Immunodeficiency Virus; I&D: Incision and drainage; TMP-SMX: Trimethoprim sulfamethoxazole; CLL: Chronic lymphocytic leukemia

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Authors’ contributions
MY performed the literature review and helped with manuscript preparation. AS gathered data and prepared the initial manuscript draft. AA contributed to patient care and helped with manuscript preparation. UA and JL contributed to patient care and offered expert advice on manuscript preparation. RL was the principal investigator. The authors have read and approved the manuscript.

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Data sharing is not applicable to this article as no datasets were generated or analysed during the current study. Data sharing is unavailable for this study as it would compromise patient privacy. However, further information regarding the case is available, within limits of patient privacy, upon request.

Ethics approval and consent to participate
This case report was performed under the Nova Scotia Health Authority Research Ethics Board guidelines for case reports. No formal research ethics board approval was necessary and therefore no reference number was generated.

Consent for publication
Informed written consent from the patient was obtained for dissemination and publishing of this case in accordance with the Nova Scotia Health Authority research ethics board guidelines.

Competing interests
The authors declare that they have no competing interests.

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