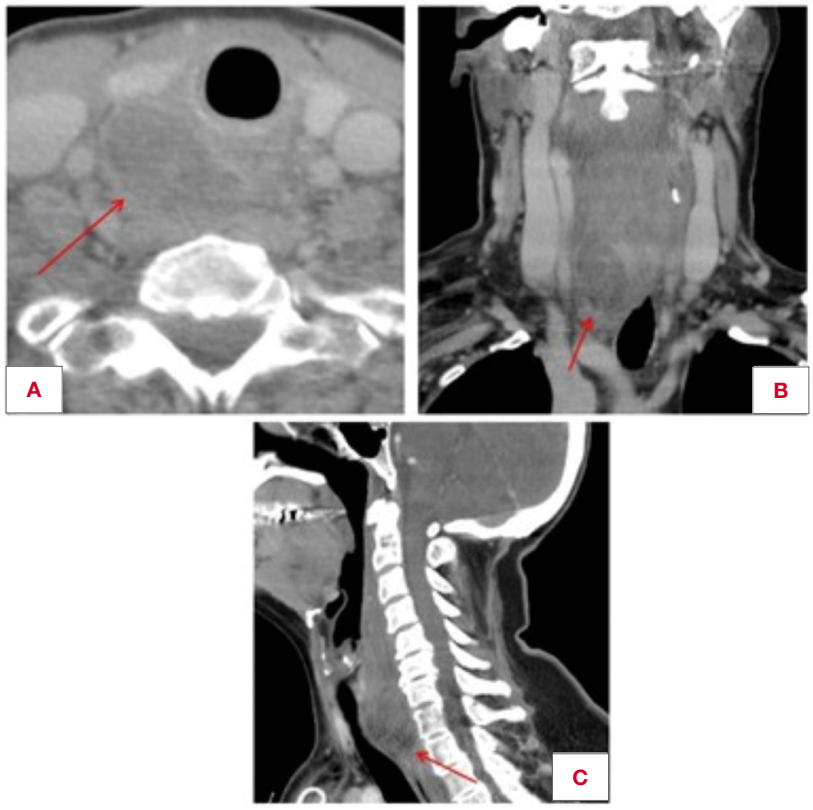
ACTA Otorhinolaryngologica Italica 2025;45:1-9; doi: 10.14639/0392-100X-N3055

Spontaneous neck haemorrhage secondary to parathyroid adenoma: description of a case and systematic review



Cover figure. Spontaneous haemorrhage of a parathyroid adenoma should be considered, particularly in middle aged, otherwise healthy women who present with neck swelling, pain, and difficulty in swallowing. A CT scan with contrast is usually sufficient for diagnosis.

Alberto Vito Marcuzzo, Sara Fadda, Kevin Cargnelutti, Simone Zucchini, Lara Bigolin, Pierluigi Bonini, Giancarlo Tirelli

ENT Clinic, Head and Neck Department, Azienda Sanitaria Universitaria Giuliano Isontina, Trieste, Italy

Received: April 22, 2024
Accepted: May 19, 2024

Correspondence
Alberto Vito Marcuzzo
E-mail: avmarcuzzo@gmail.com

How to cite this article: Marcuzzo AV, Fadda S, Cargnelutti K, et al. Spontaneous neck haemorrhage secondary to parathyroid adenoma: description of a case and systematic review. Acta Otorhinolaryngol Ital 2025;45:1-9. https://doi.org/10.14639/0392-100X-N3055

Summary

Introduction. Parathyroid adenomas can rarely cause spontaneous haemorrhage, which can be life-threatening. Diagnosis is challenging. We present a case and systematic review to define a clearer pattern of symptoms, diagnosis, and treatment.

Materials and methods. We conducted a literature search of PubMed, Google Scholar, and Embase using PRISMA guidelines, identifying 38 relevant case reports on spontaneous neck bleeding or haematoma caused by parathyroid adenomas from 1974 to 2020. Data included epidemiology, clinical features, and treatment. One patient treated at our clinic is described.

Results. Reviewing 38 articles, we found cervical haematomas from spontaneous bleeding of parathyroid adenoma in 45 patients, comprising 33 women and 12 men. Common symptoms were neck pain, dysphagia, and swelling. Surgery was the primary treatment, with 4.4% requiring tracheotomy. Average hospital stay was 12.5 days, which was mostly complication-free.
Conclusions. Parathyroid adenoma haemorrhage in middle-aged women with neck swelling, pain, and swallowing difficulty should be suspected. Diagnosis involves blood tests and contrast CT. Treatment is adenoma removal, typically without major complications.

Key words: parathyroid adenoma, spontaneous cervical haemorrhage, spontaneous cervical haematoma

Introduction

Parathyroid adenomas are benign neoplasms that are typically nonfunctional. Functioning adenomas, on the other hand, account for 90-95% of cases of primary hyperparathyroidism (PHP) [1]. PHP has an incidence of 1/1000 and is more common in women than in men, particularly in the postmenopausal age [2]. These lesions are usually oval or bean-shaped, reddish-brown in color, soft in texture, and have a bilobed or multilobulated appearance [3]. Given that adenomas are relatively small, they are typically diagnosed through routine laboratory workup that reveals asymptomatic hypercalcaemia [4]. Symptoms are numerous and diverse and surgical therapy is still the most effective treatment. Spontaneous haemorrhage of a parathyroid adenoma is a rare complication first described by Capps in 1934 [5]. The haemorrhage is usually confined to the capsule (intracapsular haemorrhage), but can occasionally spread beyond it (extracapsular haemorrhage), in which case it can compress adjacent structures such as the trachea and oesophagus, causing rapid and potentially fatal respiratory deterioration [6].
Diagnosis is usually not straightforward as the condition can mimic an inflammatory process and cause major bleeding when it occurs in the mediastinum [7]. Even if haemorrhage remains a potentially fatal complication, the literature lacks a comprehensive description of the presentation, diagnosis and treatment of parathyroid adenoma, and only case reports or small series have been published to date.
We report a case of spontaneous haemorrhage of a parathyroid adenoma and perform a systematic review of the relevant literature with the aim of defining a clearer pattern of symptoms, diagnosis, and treatment for this condition.

Materials and methods

A comprehensive literature search was independently performed by two authors (AVM and SF). The PubMed, Google Scholar and Embase databases were searched according to the PRISMA guideline. Relevant English-language studies published from January 1974 to December 2021 were identified using the keywords "parathyroid adenoma", "spontaneous cervical haemorrhage", "spontaneous cervical haematoma", "spontaneous rupture of parathyroid adenoma" and "functional parathyroid cyst". The papers retrieved for the systematic review included 38 case reports and series presenting information about symptoms, imaging and treatment of the condition (Fig. 1). The patients' epidemiological data, clinical and radiological features and treatments were recorded. Data including age, sex, symptoms, thyroid function, radiological findings, treatment and outcome of spontaneous haemorrhage of parathyroid adenoma were analysed. A case of a patient treated at our clinic is described. The patient provided informed consent for inclusion in this paper.

Case presentation

A 59-year-old woman presented to the emergency department with a 3-day history of a painful medial anterior neck swelling, odynophagia, progressive dysphagia, and fever (38°C). The patient's blood tests, prescribed a few weeks before by her family physician, showed high parathyroid hormone (PTH) (203.1 pg/mL), low vitamin D (11 ng/dL), high calcium (11.7 mg/dL) and high phosphatase alkaline (126 U/L) levels. The patient denied any recent trauma. Her medical history included hiatal hernia, inflammatory bowel disease, chronic gastritis, and osteopenia with osteoporosis. The patient had undergone tonsillectomy when a child and a hysterectomy 10 years before presentation. She was not taking anticoagulants, antiplatelets, or other drugs, except vitamin D for osteopenia. She was allergic to iodised contrast media and had a family history of thyroid disease. On presentation, her white blood cells were 9.4 x 10^3/µL, haemoglobin 13.8 g/dL and C-reactive protein (CRP) 82.3 mg/L.

Diagnostic workup and therapeutic approach

Fibroendoscopy was performed on admission with unremarkable results. Chest X-ray was negative. Neck ultrasound with color Doppler showed a Doppler-negative mixed-content mass measuring 3 x 2.5 cm in the retrothyroid area. A neck CT scan without contrast showed a well-marginated 3 x 2.5 cm (LL x CC) lesion in the median and right para-

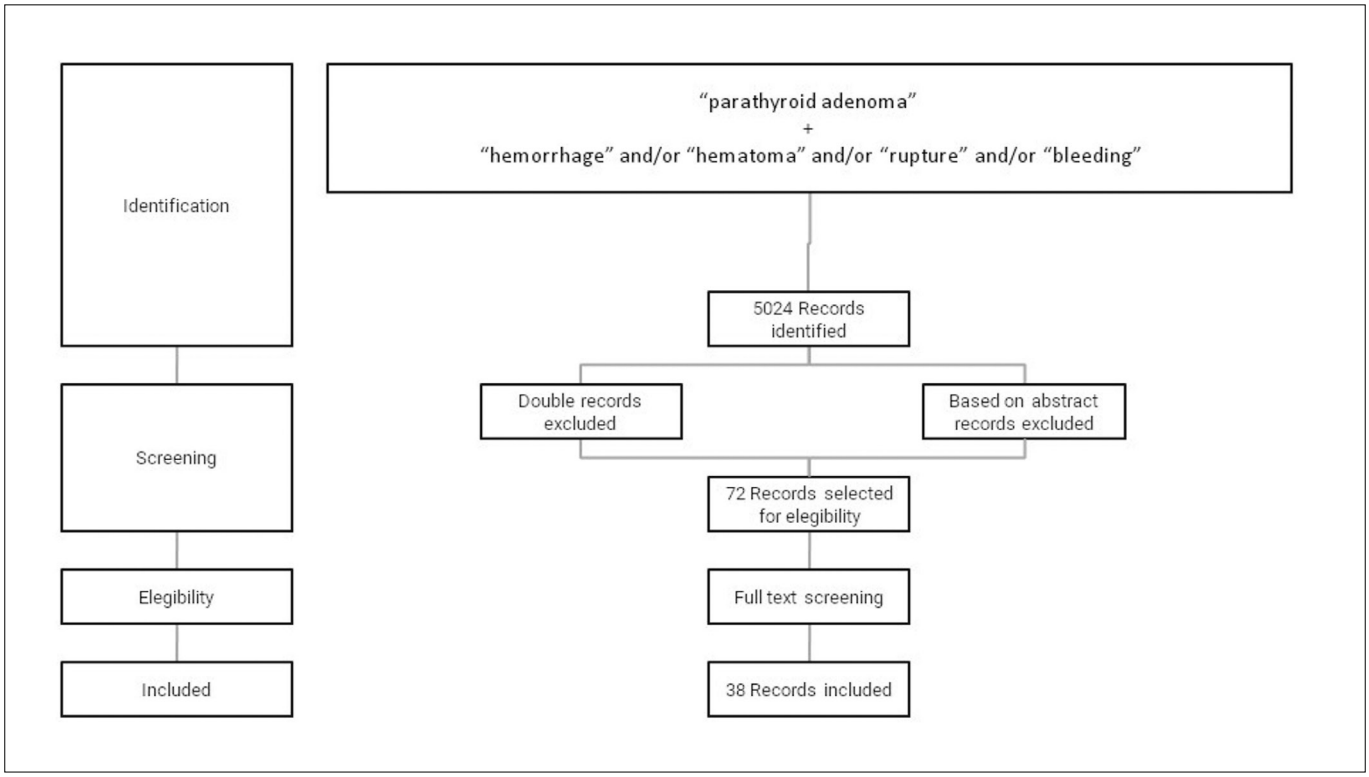


Figure 1. Preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram of the present study.

median area, almost completely cleavable by the thyroid gland. Initially, conservative medical therapy was chosen. Treatment was started with cefotaxime 1g twice daily, metronidazole 500 mg four times daily and methylprednisolone 125 mg once daily. A neck CT with contrast was performed the following day, after treating the patient with an anti-allergy protocol. She showed a slight enlargement of the lesion (4 x 2.5 cm), with unchanged characteristics. It was therefore decided to perform an exploratory cervicotomy. During surgery, a cystic neoformation with haemorrhagic content was discovered posterior to the right thyroid lobe and easily excised from the thyroid tissue. A drain was placed at the end of the surgical procedure and removed two days later. Surgery was completed without complications. Two days later, haematological examinations were conducted, revealing a significant decrease in PTH levels, dropping from 203 to 87 pg/dL. Additionally, after two years, a blood sample was taken, showing a normal PTH value of 54.3 pg/mL. Laryngeal nerve function after surgery was preserved.

Histopathology

Definitive histological examination revealed a parathyroid adenoma with chief cells, characterised by solid and follicular architecture and widespread intralesional haemorrhage.

Outcome and follow-up

Two days after surgery, the patient's CRP was 10.3 mg/L. Neither tracheotomy nor the insertion of a nasogastric tube was required. The patient was discharged 7 days after admission. At one-year follow-up the patient was in good health with no other medical problems.

Systematic review

Selected studies

Among the 38 articles included in this study, 31 were case reports, 2 case series, 4 case report reviews and 1 a case series review. The year of publication ranged from 1974 to 2020.

Epidemiology

Data for 45 patients were available. Geographic distribution was not always mentioned; only 7 articles reported the patient's ethnicity (6 Caucasian and 5 Asian). Gender dis-

tribution showed a prevalence of women over men (33 vs. 12), with a mean age of 51 years (range, 29-81) for women and 54 years (range, 30-77) for men. The overall mean age was 53 years (range, 29-81).
In most cases, these were healthy patients: 13 (28.8%) had no other comorbidity, whereas no medical history was reported for 9 of 45 cases (20%). The most frequent comorbidities were kidney stones (3 patients, 6.6%), chronic renal failure (2 patients, 4.4%), and hyperparathyroidism (2 patients, 4.4%). Alcohol and cigarette consumption was reported for 5 of 45 (11.1%) patients, but not specified for the others (Tab. I).

Symptoms

All articles described the symptoms. The most frequently reported was neck pain (30 patients, 66.6%), dysphagia (22 patients, 48.8%), swelling (21 patients, 46.6%), ecchymosis (16 patients, 35.5%), dysphonia (12 patients, 26.6%), dyspnoea (12 patients, 26.6%), fever (7 patients, 15.5%), pharyngodynia (7 patients, 15.5%), and foreign body sensation (6 patients, 13.3%). Other less frequent symptoms are reported in Table II.

Laboratory tests

Pre- and post-treatment laboratory investigations were performed in all patients. The most frequently performed blood chemistry assays were calcium (mean value 10.8 mg/dL, range 17.3-8.2 mg/dL), PTH (mean value 244.8 pg/mL, range 41.4-994 pg/mL), PTHi (intact parathyroid hormone) (mean value 410.6 pg/mL, range 64-1500 pg/mL), Hb (mean value 11.4 g/dL, range 6.3-16.4 g/dL), P (phosphate) (mean value 3.1 mg/dL, range 6-1.5 mg/dL), albumin (mean value 4.3 g/dL, range 3.2-5 g/dL), alkaline phosphatase (mean value 166 U/L, range 60-380 U/L), creatinine (mean value 3.9 mg/dL, range 0.7-13.9 mg/dL), CRP (mean value 3.2 mg/dL, range 0.2-5.7 mg/dL) and CBC (complete blood count) (Tab. III).

Imaging

All patients underwent at least one radiological investigation. The most frequently used imaging was neck CT without contrast, performed in 27 patients (60%), followed by neck ultrasound (21 patients, 46.6%) and scintigraphy (17 patients, 37.7%). Other radiological investigations performed were neck CT with contrast (8 patients, 17.7%), neck MRI without contrast (5 patients, 11.1%), and chest X-ray (15 patients, 33.3%). Parathyroid adenoma was diagnosed with imaging in 6 of 45 patients (13.3%): specifically, with SPECT in 3 out of 6 cases (50%), CT with contrast in one of 6 cases (16.6%), CT without contrast in one of 6 (16.6%), and MRI without contrast in one of 6 (16.6%). In 23 of 45 cases (51.1%), only a haematoma was described on CT scan without contrast. In one case of 45 (2.2%), a parathyroid lesion was reported without specifying its nature. In 15 cases (33.3%), imaging was not conclusive.

Treatment

All patients received surgical or medical treatment, or both. Only one patient did not receive any type of treatment.

Timing and airway protection

As for surgical treatment, it should be noted that in 11 cases (24.4%) surgery was scheduled after resolution of the acute episode, and in 23 (51.1%) it was carried out as an emergency procedure. Four patients (8.8%) required emergency intubation and 2 (4.4%) required a tracheotomy. Tracheostomy duration was 7 days in one patient and not specified in the other.
The most commonly performed surgical treatment was exploratory cervicotomy (22 patients, 48.8%). In some cases, it was combined with thyroid lobectomy (2 patients, 9%) and parathyroidectomy (3 patients, 13.6%). Other types of surgical treatment included: median sternotomy (2 patients, 4.4%), thyroid lobectomy (one patient, 2.2%), parathyroidectomy (4 patients, 8.8%), parathyroidectomy with thyroid lobectomy (2 patients, 4.4%), hemithyroidectomy (2 patients, 4.4%), hemithyroidectomy with parathyroidectomy (one patient, 2.2%). In all surgical procedures performed, the search for recurrent laryngeal nerve was not mentioned except in 2 cases where it was described as an incidental finding near the mass [10,29] (Tab. IV).
Medical treatment, on the other hand, was mostly based on hydration, antibiotic therapy, and steroids. Four patients (8.8%) received antibiotic therapy alone. The duration of antibiotic treatment was reported in only one case (5 days). Eleven patients (24.4%) received both medical and surgical treatment.

Outcomes and follow-up

The average length of hospitalisation was 12.5 days (range 3-73), but these data were reported for only 15 patients. Most patients suffered no complications during the hospital stay, whereas recurrent nerve palsy was reported in 4 patients (8.8%). No patient required placement of a feeding tube, and all patients showed improvement in their condition after treatment. Only one death due to cerebral anoxia occurred. Follow-up was not mentioned, except for one case report, in which the reported disease-free interval was 13 years.

Discussion

Spontaneous bleeding of a parathyroid adenoma is a rare complication and only case reports or case series can be

Table I. Characteristics of the selected studies and demographic data.

Author	Year	Type	Patients	Sex	Age	Ethnicity
Berry [26]	1974	CR	1	M	63	ND
Santos [8]	1975	CR	1	F	47	ND
Jordan [32]	1981	CR	1	F	38	ND
Hotes [6]	1989	CR	1	F	73	ND
Simcic [38]	1989	CR	1	M	32	ND
Amano [25]	1993	CR	1	M	64	ND
Korkis [24]	1993	CR	1	F	81	Caucasian (1)
Hellier [9]	1997	CR	1	F	52	ND
Chin [28]	1998	CR	1	M	37	ND
Ku [19]	1998	CR	1	F	80	Asian (1)
Kovacs [35]	1998	CR	1	M	49	ND
Santelmo [10]	1999	CR	1	F	63	ND
Kozlow [11]	2001	CR	1	F	48	ND
Kihara [12]	2001	CR	1	F	60	ND
Shundo [37]	2002	CR	1	M	50	ND
Chaffanjon [13]	2002	CS	4	F (4)	61*	ND
Tonerini [39]	2004	CR	1	M	30	ND
Kouloris [34]	2006	CR	1	F	68	ND
Nito [14]	2007	CR	1	F	55	ND
Shim [36]	2008	CR	1	F	44	ND
Merante-Boschin [15]	2009	CR	1	F	56	Caucasian (1)
Rehman [43]	2010	CR	1	F	72	ND
Whitson [42]	2011	CR	1	F	49	ND
Inokuchi [31]	2011	CR	1	M	75	ND
Huang J [16]	2012	CR	1	F	56	ND
Nagasawa [20]	2012	CR	1	M	52	Asian (1)
Yoshimura [7]	2014	CR	1	F	47	ND
Van den Broek [41]	2015	CR	1	F	79	ND
Ulrich [17]	2015	CR	1	F	54	ND
Ilyicheva [30]	2015	CR	1	F	29	ND
Shinomiya [21]	2015	CS	2	M (1), F (1)	62, 76	Asian (2)
Hanashiro [22]	2017	CR	1	F	72	Asian (1)
Garrahy [29]	2017	CR	1	F	45	ND
Carneiro de Sousa [27]	2018	CR	1	F	74	ND
Khan S [33]	2019	CR	1	F	69	ND
Uehara [40]	2019	CR	1	M	77	ND
Zammit [18]	2020	CR	1	F	65	ND
Tessler [23]	2020	CS	4	M (1), F (3)	57, 59, 67, 75	Caucasian (4)
Total			45	F:M = 2.7:1	Mean age (range)	
					53 (29-81)	

*CR: case report; CS: case series; ND: no data; M: male; F: female. *: the case series does not report the ages of all patients but only the mean.*

found in the literature. However, because it is a potentially fatal condition, accurate diagnosis and appropriate management are critical. In this review, we present a case report of a patient with spontaneous bleeding of a parathyroid ad-

Table II. Symptoms and incidence reported in the selected studies.

Symptom	Number of patients (%)
Neck pain	30 (66.7%)
Dysphagia	22 (48.9%)
Swelling	21 (46.7%)
Bruising	16 (35.6%)
Dysphonia	12 (26.7%)
Dyspnoea	12 (26.7%)
Fever	7 (15.6%)
Pharyngodynia	7 (15.6%)
Sense of foreign body	6 (13.3%)
Odinophagy	4 (8.9%)
Shortness of breath	4 (8.9%)
Dry cough	4 (8.9%)
Asthenia	2 (4.4%)
Weight loss	2 (4.4%)
Sialorrhoea	2 (4.4%)
Myalgia	2 (4.4%)
Cognitive dysfunction	1 (2.2%)
Constipation	1 (2.2%)
Dehydration	1 (2.2%)
Dizziness	1 (2.2%)
Diaphoresis	1 (2.2%)
Otalgia	1 (2.2%)
Polyuria	1 (2.2%)
Polydipsia	1 (2.2%)
Palpitations	1 (2.2%)

Table III. Laboratory values reported in the selected studies.

Parameter	Mean value (range)
Calcium (mg/dL)	10.8 (8.2-17.3)
PTH (pg/mL)	244.8 (41.4-994)
iPTH (pg/mL)	410.6 (64-1500)
Hb (g/dL)	11.4 (6.3-16.4)
P (mg/dL)	3.1 (1.5-6)
Albumin (g/dL)	4.3 (3.2-5)
Alkaline P (U/L)	166 (60-380)
Creatinine (mg/dL)	3.9 (0.7-13.9)
CRP (mg/dL)	3.2 (0.2-5.7)

PTH: parathyroid hormone; iPTH: intact PTH; Hb: haemoglobin; P: phosphate; CRP: C-reactive protein.

Table IV. Surgical treatments.

	Nº patients	%
Exploratory cervicotomy	22	48.8
Partial excision of the thyroid gland (hemithyroidectomy/lobectomy)	5	15.6
Parathyroidectomy	7	22.4
Parathyroidectomy + partial excision of the thyroid gland (hemithyroidectomy/lobectomy)	3	6.6
Median sternotomy	2	4.4
Tracheotomy	2	4.4

enoma and summarise the current findings reported in the literature. Our patient was a 59-year-old Caucasian woman with no significant comorbidities. According to the literature, the majority of patients affected by this complication are middle-aged women in good health [8-19]. Although only 7 publications covered ethnicity, there does not seem to be any obvious ethnic predominance in terms of geographic distribution [15,19,24]. This complication has a relatively vague clinical presentation, making the differential diagnosis often difficult. However, the main features reported in the literature were present in our case, given that she had pain, neck swelling, odynophagia, progressive dysphagia, and fever. Other symptoms are ecchymosis, dysphonia, dyspnoea, pharyngodynia, and foreign body sensation. There have been no reports of asymptomatic cases.

The diagnostic workup must include blood chemistry and radiological investigations. In our case, the patient had been examined by a general physician a few weeks prior to presentation and had been prescribed blood tests that showed high PTH, low vitamin D, high calcium and high alkaline phosphatase levels. On admission, we measured the inflammatory indices, which were 9.4 x 10^3/µL for white blood cells and 82.3 mg/L for CRP. All cases reported in the literature [1-38] also underwent pre- and post-treatment laboratory investigations, with a focus on calcium metabolism and inflammatory markers. The data indicate that when a parathyroid adenoma bleeds spontaneously, there is a rise in the levels of PTH, calcium, alkaline phosphatase, and CRP. The most common radiological examination was non-contrast CT [7,11-13,15-17,20-23,25,27-31,38-39,42,43]. According to the published findings, SPECT is the most informative approach for patients developing this complication [18,29,41]. Nevertheless, SPECT, which is not available in all medical facilities, was shown to be conclusive in only 3 of 17 cases [18,29,41], reflecting a very limited series.

Therefore, the literature data show that contrast-enhanced CT is sufficient and quite reliable for the initial diagnosis. Other radiological investigations performed were non-contrast neck MRI, chest X-ray and neck ultrasound, none of which provided useful information for diagnosis or treatment. Even the most recent 3D techniques are not reported to provide additional information [44].

It should be noted that the final diagnosis is achieved through histological examination. As for treatment, initial conservative therapy with antibiotics and steroids is frequently mentioned [23,24,27,31,32,37]. This approach is most likely the result of a delayed diagnosis. In our situation, medical treatment was given prior to the CT scan. In fact, the negative Doppler ultrasound and the absence of anaemia ruled out active bleeding, while the lack of fever and the relatively high inflammatory indices allowed for a watchful wait until the diagnosis was established. The literature describes some cases treated only with medical care. The authors suggesting this approach argue that haematomas can sometimes obscure normal anatomy, making identification of the adenoma more difficult and prompt surgical exploration risky. Another reason for not performing acute-phase surgery is the phenomenon of auto-parathyroidectomy, whereby spontaneous parathyroid bleeding can cause a temporary remission and sometimes even permanent control of hyperparathyroidism and its metabolic imbalances [13,29,41]. In the latter scenario, surgery became unnecessary, and the patients did not undergo any operations. If the hyperparathyroidism persists, a delayed parathyroidectomy should be scheduled after the haematoma has reabsorbed. A minimum delay of 3 months has been proposed by Chaffanjon et al. in order to facilitate successful surgical treatment [13].

The exploratory cervicotomy performed in our patient revealed a cystic neoformation with haemorrhagic content that was excised from the posterior surface of the thyroid lobe. According to the literature, exploratory cervicotomy is the most commonly performed surgical procedure that results in resolution of the clinical picture in the majority of cases [7,10,11,16,17,19-21,23-25,28,30,32,36,37,39,42,43]. In some instances, exploratory cervicotomy was performed in conjunction with thyroid lobectomy and parathyroidectomy, for two reasons: either because of the close anatomic relationships between the parathyroid adenoma and the surrounding tissue or because the exact site of origin of the haemorrhage could not be identified[13,21,23,32,37]. Because this complication could mimic a major haemorrhage or a mediastinal inflammatory process, a median sternotomy was described in 2 cases.

Tracheotomy is rarely needed; only 2 patients in the literature we reviewed required a tracheotomy for breathing difficulties. It has to be considered that due to the fact that this pathology is correlated to hyperparathyroidism, performing a parathyroidectomy should be considered in all cases in wich a cervicotomy is performed for the haemorrhage of the adenoma. As in our case, explorative cervicotomy with excision of the adenoma is usually free of complications; according to the literature, the most commonly reported sequela is unilateral recurrent laryngeal nerve paralysis (4 cases, 8.8%). The reported risk for recurrent laryngeal nerve injury after thyroid/parathyroid surgery varies among centres, with rates up to 38% [45,46]. The rate is usually lower in some centres due to direct visualisation of the nerve and the use of intraoperative nerve monitoring, which reduce the incidence of nerve deficit to 1-2% [48]. The need to place a feeding tube was not described in any case. In the articles analysed, follow-up was mentioned in only one case, lasting 13 years [23]. In our case, clinical follow-up was regular, and a thyroid and parathyroid ultrasound scan performed 12 months after surgery showed no evidence of recurrence or other complications.

Conclusions

Spontaneous haemorrhage of a parathyroid adenoma should be considered, particularly in middle-aged, otherwise healthy women who present with neck swelling, pain, and difficulty in swallowing, with no other symptoms or signs observed during laryngoscopic examination. Blood chemistry tests are essential, with particular emphasis on calcium metabolism and inflammatory indices, which will often show increased levels of PTH, calcium, and alkaline phosphatase. A CT scan with contrast is usually sufficient for diagnosis. Today, the most appropriate radiological imaging for sensitivity and specificity in detecting parathyroid adenomas is 4-dimensional CT, first studied by Rodgers et al. in 2006 [49]. Once a correct diagnosis has been made, the primary treatment is surgical and involves an exploratory cervicotomy with removal of the adenoma; other surgical procedures are typically performed because of a lack of an accurate diagnostic process. In most cases, airway control is not necessary. If properly identified, spontaneous haemorrhage of a parathyroid adenoma can be resolved without sequelae or major complications.

Conflict of interest statement

The authors declare no conflict of interest.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author contributions

AVM, GT, PB: concept and draft; SF, KC, LB, SZ: data analysis and review; AVM, GT: final review.

Ethical consideration

No ethical committee approval is needed for reviews.

We confirm that the research was conducted ethically, with all study procedures being performed in accordance with the requirements of the World Medical Association's Declaration of Helsinki.

Written informed consent was obtained from each participant/patient for study participation and data publication.

References

1 Hammett-Stabler CA, Maygarden SJ, Reisner HM. Pathology of the endocrine system. Pathology: a modern case study. New York, NY: McGraw-Hill; 2014.

2 Haden ST, Stoll AL, McCormick S, et al. Alterations in parathyroid dynamics in lithium-treated subjects. J Clin Endocrinol Metab 1997;82:2844-2848. https://doi.org/10.1210/jcem.82.9.4218

3 Fialkow PJ, Jackson CE, Block MA, et al. Multicellular origin of parathyroid "adenomas". N Engl J Med 1977;297:696-698.

4 Silverberg SJ, Bilezikian JP. Evaluation and management of primary hyperparathyroidism. J Clin Endocrinol Metab 1996;81:2036-2040. https://doi.org/10.1210/jcem.81.6.8964825

5 Capps RB. Multiple parathyroid tumors with massive mediastinal and subcutaneous hemorrhage: a case report. Am J Med Sci 1934;188:800- 805.

6 Hotes LS, Barzilay J, Cloud LP, et al. Spontaneous hematoma of a parathyroid adenoma. Am J Med Sci 1989;297:331-333. https://doi.org/10.1097/00000441-198905000-00012

7 Yoshimura N, Mukaida H, Mimura T, et al. A case of an acute cervicomediastinal hematoma secondary to the spontaneous rupture of a parathyroid adenoma. Ann Thor Cardiovasc Surg 2014;20(Suppl) 816-882. https://doi.org/10.5761/atcs.cr.12.02060

8 Santos GH, Tseng CL, Frater RW. Ruptured intrathoracic parathyroid adenoma. Chest 1975;68:844-846. https://doi.org/10.1378/chest.68.6.844

9 Hellier WP, McCombe A. Extracapsular haemorrhage from a parathyroid adenoma presenting as a massive cervical haematoma. J Laryngol Otol 1997;111:585-587. https://doi.org/10.1017/S0022215100137995

10 Santelmo N, Hirschi S, Sadoun D, et al. Bilateral hemothorax revealing mediastinal parathyroid adenoma. Respiration 1999;66:176-178. https://doi.org/10.1159/000029364

11 Kozlow W, Demeure MJ, Welniak LM, et al. Acute extracapsular parathyroid hemorrhage: case report and review of the literature. Endocr Pract 2001;7:32-36. https://doi.org/10.4158/EP.7.1.32

12 Kihara M, Yokomise H, Yamauchi A, et al. Spontaneous rupture of a parathyroid adenoma presenting as a massive cervical hemorrhage: report of a case. Surg Today 2001;31:222-224. https://doi.org/10.1007/s005950170172

13 Chaffanjon PC, Chavanis N, Chabre O, et al. Extracapsular hematoma of the parathyroid glands. World J Surg 2003;27:14-17. https://doi.org/10.1007/s00268-002-6429-y

14 Nito T, Miyajima C, Kimura M, et al. Parathyroid adenoma causing spontaneous cervical hematoma: a case report. Acta Otolaryngol Suppl 2007;559:160-163. https://doi.org/10.1080/03655230701600491

15 Merante-Boschin I, Fassan M, Pelizzo MR, et al. Neck emergency due to parathyroid adenoma bleeding: a case report. J Med Case Rep 2009;3:7404. https://doi.org/10.1186/1752-1947-3-7404

16 Huang J, Soskos A, Murad SM, et al. Spontaneous hemorrhage of a parathyroid adenoma into the mediastinum. Endocr Pract 2012;18:E57-E60. https://doi.org/10.4158/EP11329.CR

17 Ulrich L, Knee G, Todd C. Spontaneous cervical haemorrhage of a parathyroid adenoma. Endocrinol Diabetes Metab Case Rep 2015;2015:150034. https://doi.org/10.1530/EDM-15-0034

18 Zammit M, Siau R, Panarese A. Importance of serum calcium in spontaneous neck haematoma. BMJ Case Rep 2020;13:E237267. https://doi.org/10.1136/bcr-2020-23726719

19 Ku P, Scott P, Kew J, et al. Spontaneous retropharyngeal haematoma in a parathyroid adenoma. Aust N Z J Surg 1998;68:619-621. https://doi.org/10.1111/j.1445-2197.1998.tb02117.x

20 Nagasawa M, Ubara Y, Suwabe T, et al. Parathyroid hemorrhage occurring after administration of cinacalcet in a patient with secondary hyperparathyroidism. Intern Med 2012;51:3401-3404. https://doi.org/10.2169/internalmedicine.51.8055

21 Shinomiya H, Otsuki N, Takahara S, et al. Parathyroid adenoma causing spontaneous cervical hematoma: two case reports. BMC Res Notes 2015;8:726. https://doi.org/10.1186/s13104-015-1611-0

22 Hanashiro N, Yamashiro T, Iraha Y, et al. Non-traumatic rupture of the superior thyroid artery with concomitant parathyroid adenoma and multinodular goiter. Acta Radiol Open 2017;6:2058460117722813. https://doi.org/10.1177/20584601177228

23 Tessler I, Adi M, Diment J, et al. Spontaneous neck hematoma secondary to parathyroid adenoma: a case series. Eur Arch Otorhinolaryngol 2020;277:2551-2558. https://doi.org/10.1007/s00405-020-05959-z

24 Korkis AM, Miskovitz PF. Acute pharyngoesophageal dysphagia secondary to spontaneous hemorrhage of a parathyroid adenoma. Dysphagia 1993;8:7-10. https://doi.org/10.1007/BF01351471

25 Amano Y, Fukuda I, Mori H, et al. Hemorrhage from spontaneous rupture of a parathyroid adenoma (a case report). Ear Nose Throat J 1993;72:794-899.

26 Berry BE, Carpenter PC, Fulton RE, et al. Mediastinal hemorrhage from parathyroid adenoma simulating dissecting aneurysm. Arch Surg 1974;108:740-741. https://doi.org/10.1001/archsurg.1974.01350290102019

27 Carneiro de Sousa P, Gambôa I, Duarte D, et al. Nontraumatic parapharyngeal haematoma: a rare lesion. Case Rep Otolaryngol 2018;2018:7340937. https://doi.org/10.1155/2018/7340937

28 Chin KW, Sercarz JA, Wang MB, et al. Spontaneous cervical hemorrhage with near-complete airway obstruction. Head Neck 1998;20:350-353. https://doi.org/10.1002/(SICI)1097-0347(199807)20:4<350::AID-HED10>3.0.CO;2-M

29 Garrahy A, Hogan D, O'Neill JP, et al. Acute airway compromise due to parathyroid tumour apoplexy: an exceptionally rare and potentially life-threatening presentation. BMC Endocr Disord 2017;17:35. https://doi.org/10.1186/s12902-017-0186-2

30 Ilyicheva E. Spontaneous cervical-mediastinal hematoma caused by hemorrhage into parathyroid adenoma: a clinical case. Int J Surg Case Rep 2015;6C:214-7. https://doi.org/10.1016/j.ijscr.2014.10.029

31 Inokuchi G, Kurita N, Baba M, et al. Retropharyngeal hematoma from parathyroid hemorrhage in a hemodialysis patient. Auris Nasus Larynx 2012;39:527-530. https://doi.org/10.1016/j.anl.2011.09.002

[32] Jordan FT, Harness JK, Thompson NW. Spontaneous cervical hematoma: a rare manifestation of parathyroid adenoma. Surgery 1981;89:697-700.

[33] Khan S, Choe CC, Shabaik A, et al. Parathyroid adenoma presenting with spontaneous cervical and anterior mediastinal hemorrhage: a case report. Medicine (Baltimore) 2019;98:E14347. https://doi.org/10.1097/MD.0000000000014347

[34] Koulouris G, Pianta M, Stuckey S. The 'sentinel clot' sign in spontaneous retropharyngeal hematoma secondary to parathyroid apoplexy. Ear Nose Throat J 2006;85:606-608.

[35] Kovacs KA, Gay JD. Remission of primary hyperparathyroidism due to spontaneous infarction of a parathyroid adenoma. Case report and review of the literature. Medicine (Baltimore) 1998;77:398-402.

[36] Shim WS, Kim IK, Yoo SD, et al. Non-functional parathyroid adenoma presenting as a massive cervical hematoma: a case report. Clin Exp Otorhinolaryngol 2008;1:46-48. https://doi.org/10.3342/ceo.2008.1.1.46

[37] Shundo Y, Nogimura H, Kita Y, et al. Spontaneous parathyroid adenoma hemorrhage. Jpn J Thorac Cardiovasc Surg 2002;50:391-394. https://doi.org/10.1007/BF02913192

[38] Simcic KJ, McDermott MT, Crawford GJ, et al. Massive extracapsular hemorrhage from a parathyroid cyst. Arch Surg 1989;124:1347-1350. https://doi.org/10.1001/archsurg.1989.01410110109023

[39] Tonerini M, Orsitto E, Fratini L, et al. Cervical and mediastinal hematoma: presentation of an asymptomatic cervical parathyroid adenoma: case report and literature review. Emerg Radiol 2004;10:213-215. https://doi.org/10.1007/s10140-003-0317-0

[40] Uehara A, Suzuki T, Yamamoto Y, et al. A functional parathyroid cyst from the hemorrhagic degeneration of a parathyroid adenoma. Intern Med 2020;59:389-394. https://doi.org/10.2169/internalmedicine.3319-19

[41] Van den Broek JJ, Poelman MM, Wiarda BM, et al. Extensive cervicomediastinal hematoma due to spontaneous hemorrhage of a parathyroid adenoma: a case report. J Surg Case Rep 2015;2015:rjv039. https://doi.org/10.1093/jscr/rjv039

[42] Whitson BA, Heckmann R, Manivel C, et al. Acute airway compromise from a hemorrhagic posterior cervical-mediastinal mass: rare presentation of a parathyroid adenoma. J Thorac Dis 2011;3:68-70. https://doi.org/10.3978/j.issn.2072-1439.2010.11.7

[43] Rehman HU, Markovski M, Khalifa A. Spontaneous cervical hematoma associated with parathyroid adenoma. CMAJ 2010;182:E632. https://doi.org/10.1503/cmaj.091167

[44] Tirelli G, de Groodt J, Sia E, et al. Accuracy of the Anatomage Table in detecting extranodal extension in head and neck cancer: a pilot study. J Med Imaging (Bellingham) 2021;8:014502. https://doi.org/10.1117/1.JMI.8.1.014502

[45] Jeannon JP, Orabi AA, Bruch GA, et al. Diagnosis of recurrent laryngeal nerve palsy after thyroidectomy: a systematic review. Int J Clin Pract 2009;63:624-629. https://doi.org/10.1111/j.1742-1241.2008.01875.x

[46] Mattsson P, Hydman J, Svensson M. Recovery of laryngeal function after intraoperative injury to the recurrent laryngeal nerve. Gland Surg 2015;4:27-35. https://doi.org/10.3978/j.issn.2227-684X.2015.01.10

[47] Tian H, Pan J, Chen L, et al. A narrative review of current therapies in unilateral recurrent laryngeal nerve injury caused by thyroid surgery. Gland Surg 2022;11:270-278. https://doi.org/10.21037/gs-21-708

[48] Tirelli G, Bergamini PR, Scardoni A, et al. Intraoperative monitoring of marginal mandibular nerve during neck dissection. Head Neck 2018;40:1016-1023. https://doi.org/10.1002/hed.25078

[49] Rodgers SE, Hunter JG, Hamberg LM, et al. Improved preoperative planning for directed parathyroidectomy with 4-dimensional computed tomography. Surgery 2006;140:932-940; discussion 940-941. https://doi.org/10.1016/j.surg.2006.07.028