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Case Report

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Breaking Stereotypes: Polycythemia Secondary to Shisha Smoking in a Middle-Age Swiss Woman

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Abstract
The diagnosis of polycythemia, particularly the secondary forms, can be challenging. The distinction between primary and secondary polycythemia is relevant and has management implications. A systematic diagnostic workup algorithm and a good anamnesis are of paramount relevance. More than one cause may be involved in the development of polycythemia, identifying all of them will be the key to better understanding and eventually solving the polycythemia. We describe a case of a 53-year-old Swiss woman with polycythemia and a high level of carboxyhemoglobin. Her medical story included obesity and obstructive sleep apnea. The anamnesis ruled out the habit of smoking cigarettes; however, the patient reported that she was on a trip to Egypt 10 years before and bought herself a shisha; since then, she used to smoke shisha daily, at home, alone. After drastically reducing and then stopping the shisha smoking, 7 months later her blood count and carboxyhemoglobin completely normalized.

Introduction

According to the World Health Organization (WHO), polycythemia is defined as increased hemoglobin above 165 g/L in men and 160 g/L in women, or as increased hematocrit above 49% in men and 48% in women [1]. When confronting a patient with polycythemia, secondary causes are an important differential diagnosis to primary polycythemia. Several parameters contribute to the characterization of the underlying pathophysiological mechanisms involved in the development of secondary polycythemia. Thus, secondary polycythemia is sometimes related to high erythropoietin (EPO) levels; this may be due to tumor secreting EPO (such as renal cell carcinoma, hepatocellular carcinoma, cerebellar hemangioblastoma), medications (such as anabolic steroids), or hypoxia [2]. Hypoxia-induced polycythemia is related to cardiopulmonary pathologies, such as chronic obstructive pulmonary disease, living at high altitudes, and smoking [2]. Within this, polycythemia secondary to smoking represents one of the most common secondary causes. The smoking of carbon monoxide (CO) enters the blood through the lungs, binds hemoglobin with an affinity 200–250 times greater than that of oxygen, and forms carboxyhemoglobin (COHb), shifting leftward the oxyhe-

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Table 1. Laboratory at the diagnosis and follow-up

	Day 0*		Day 14	Day 25		Day 205
Hemoglobin (121–134 g/L)	186↑		168↑	157↑		132
Hematocrit (36–44%)	56.2↑		50↑	47↑		38
Erythrocytes (3.90–5.00 T/L)	6.34↑		5.94↑	5.58↑		4.73
MCV (80–98 pg)	88.6		84	85		81
MCH (27–33 pg)	29.3		28	28		28
Platelets (150–450 G/L)	247		318	224		267
Leucocytes (3.00–10.5 G/L)	7.8		7.41	5.72		6.50
EPO (4.20–19.0 mU/mL)	–	**Phlebotomy**	24.5↑	–	**Shisha smoking reduction until stop**	–
pH venous (7.35–7.45)	–		7.413	–		7.401
pCO2 (32–43 mm Hg)	–		42	–		40
pO2 venous (71–104 mm Hg)	–		29↓	–		63↓
P50 venous (24–28 mm Hg)	–		21↓	–		28
O2 saturation (93–98%)	–		69↓	–		91↓
COHb	–		22.7	–		2.6
Metha-hemoglobin	–		1.5	–		0.8
O2-hemoglobin	–		52			88

MCV, means corpuscular volume; MCH, mean corpuscular hemoglobin; pH, potential of hydrogen; pCO2, partial pressure of carbon dioxide; pO2, partial pressure of oxygen; COHb, carboxyhemoglobin; O2-hemoglobin, oxyhemoglobin.

moglobin dissociation curve [3, 4]. As a result of the tissue hypoxia, patients with a high level of COHb may present secondary polycythemia [5].

Shisha (also known as narghilè, water pipe, hookah pipe, and hubbly bubbly) is a smoking device, used to smoke jurak, which is a mixture of tobacco and fruit [6]. It used to be a habit on the decline for most part of the 20th century, but starting from the 1990s became popular again among Middle Eastern men [7]. Since then, it spread globally, especially among the young generations. Among 1,454 Jordan university students, 21% of the males were smoking only shisha, 42% of the males were smoking cigarettes and shisha, 63% of the females were smoking only shisha, and 14% cigarettes and shisha [8]. Among students from 152 US universities, 30.5% reported ever smoked shisha and 8.4% reported current use; the smokers were mainly of male gender and younger age [9].

Case Report

We report the case of a 53-year-old Swiss woman, referred to our center by her general doctor because of polycythemia of unknown origin. The patient presented with facial plethora and was suffering from fatigue but had no hyperviscosity symptoms. She had a history of metabolic syndrome (obesity, arterial hypertension, dyslipidemia, and diabetes mellitus type 2), obstructive sleep apnea treated with the use of continuous positive airway pressure during the night, depression, attention deficit disorder, and bilateral gonarthrosis. No thrombosis was reported. She was on treatment with aripiprazole, clotiapine, lamotrigine, quetiapine, lorazepam, trazodone, moclobemide, candesartan, chondritinsulfat, gliclazide, cholestyramine, rosuvastatin, vitamin D, and vitamin B12. The last checkup for her metabolic syndrome was performed by her general practitioner and showed a HbA1c of 6%, triglycerides of 1.17 mmol/L, HDL cholesterol of 1.06 mmol/L, and LDL cholesterol of 1.56 mmol/L.

She used to drink alcohol occasionally on weekends and she was not a cigarette smoker. Insisting on the anamnesis, she reported smoking shisha daily, 3 times per day, for around 10 years.

The patient was in good clinical condition and she has a body mass index of 32.5 kg/m^2. The laboratory performed at the consultation of her general practitioner showed high hemoglobin and hematocrit which were 186 g/L and 56.2%, respectively; otherwise, values were within the normal range. The previous complete blood count was 4 years before and it was normal. Initially, polycythemia vera was suspected and phlebotomy was performed. In the meanwhile, a molecular diagnostic was performed, where no JAK2-V617F mutations were found.

In our outpatient clinic 14 days after the first phlebotomy, the hemoglobin was 168 g/L and the hematocrit 50%. In the venous blood gas analysis, the COHb was 22.7%, the oxyhemoglobin was 52%, the pO_2 29 mm Hg, and the p50 was 21 mm Hg; the results showed indeed an impressively high COHb (Table 1).

The high concentration of COHb and the habit of daily shisha smoking seemed to play a relevant role in this case and this was suspected as the main cause of the polycythemia. The diagnosis was discussed with the patient and she reduced immediately her shisha usage from 3 times/day to 3 times/week.

In the control after almost 7 months, her complete blood count completely normalized, and the results of the venous blood gas analysis improved. The patient was queried about her current

smoking habit and she mentioned that she was on holiday for 6 weeks before coming to the consultation and she did not smoke at all during this time. Furthermore, she reported a clear improvement in her fatigue.

Discussion/Conclusion

The diagnosis of polycythemia, particularly the secondary forms, can be challenging. The diagnosis has therapeutic implications since the management will not be the same if the patient has myeloproliferative neoplasms, such as polycythemia vera, or if the diagnosis is a secondary form, where polycythemia may be basically a compensatory process due to different causes and does not necessarily need therapeutic interventions such as phlebotomy. Furthermore, some patients will have many possible causes for polycythemia; identifying one cause does not necessarily imply stopping the diagnostic process until all the possible causes have been investigated. To diagnose primary polycythemia (or polycythemia vera), 3 of the major criteria (polycythemia, trilinear bone marrow myeloproliferation, and mutation in the *JAK2* gene) or 2 of the major criteria and the minor criteria (low EPO level) are needed according to the WHO 2016 classification [1]. In this case, the hypothesis of polycythemia vera was ruled out from day 14 because of the high EPO level and the negativity of the *JAK2V617F* mutation.

In parallel, we focused on the secondary causes. Our patient was taking a discrete number of different medications, but none of them is associated with secondary polycythemia. She was suffering from sleep apnea, which could cause secondary polycythemia, but she was under continuous positive airway pressure treatment; compliance with treatment was assessed and appeared to be correct, suggesting that other causes might be more likely playing a role.

When asked explicitly about the smoking habit, she denied smoking cigarettes, but she referred to smoking shisha on a regular base. She was on a trip to Egypt and bought herself a shisha. Since then, she used to smoke daily, at home, alone, except when she was traveling. It was remarkable the impressively high level of COHb in this patient. Shisha smoking is generally seen as harmless in comparison with cigarette smoking, but actually, the levels of COHb are mostly higher in shisha smokers in comparison with cigarette smokers: nonsmokers have in mean 1.7% COHb, cigarette smokers 6.6%, and shisha smokers 8.8% [10]. In the Netherlands was observed a level of COHb of 21% in a reported patient with shisha addiction and a facial plethora [11]. Another case of polycythemia in a shisha smoker described almost 10 years ago was presented with irritability, dizziness, impaired concentration, reduced physical performance, and a COHb of 6% [12]. The COHb concentration associated with shisha smoking is variable and the symptoms do not directly depend on the concentration, as pointed out by a German group [13]. It is important to remark that the COHb in shisha smokers can be high and the patient can still be asymptomatic [14].

Although this patient had several causes that could explain the polycythemia, the assiduous habit of smoking shisha, even repeatedly during the day, was undoubtedly striking. The proof of our hypothesis that the polycythemia was secondarily provoked by the regular consumption of shisha was confirmed after a drastic reduction of this habit, allowing a complete normalization of the COHb and hemoglobin/hematocrit.

In investigating causes in a patient with polycythemia, enough time should be invested in collecting a detailed anamnesis. Aspects related to hobbies, amenities, and habits could provide additional relevant information. Furthermore, we should not be stopped from common stereotypes since nowadays people do travel or have easy access to discover habits that are far away from the original culture and they can be even included in everyday life. Perhaps one of the greatest challenges is that in those patients with obvious possible causes (such as obesity or already carrying the diagnosis of sleep apnea as it was in this patient), there is a need to further investigate all potentially secondary causes. In fact, even in medicine, sometimes what is important is not obvious.

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We thank the patient for providing consent for the publication.

Statement of Ethics

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. Ethical approval is not required for this study in accordance with local or national guidelines.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

Nada Agbariah and Alicia Rovó contributed to conception and design of the study and they both contributed to manuscript revision, read, and approved the submitted version.

Data Availability Statement

All data generated or analyzed are included in this case report. Further inquiries can be directed to the corresponding author.

References

1 Swerdlow SH, Campo E, Harris NL, Jaffe ES, Pileri SA, Stein H, et al. WHO classification of tumours of haematopoietic and lymphoid tissues. 4th ed. International Agency for Research on Cancer (IARC); 2017

2 Haider MZ, Anwer F. Secondary polycythemia. In. StatPearls. Treasure Island (FL): StatPearls Publishing; 2022.

3 Weaver LK. Clinical practice. Carbon monoxide poisoning. N Engl J Med. 2009;360(12):1217–25.

4 Ernst A, Zibrak JD. Carbon monoxide poisoning. N Engl J Med. 1998;339(22):1603–8.

5 Moodley T, Mannaru KT, Hugo A, Lines JA, Van der Merwe JM, Ramparsad N, et al. Secondary polycythaemia with elevated carbon monoxide levels due to hookah pipe smoking: a public health concern. South African Med J. 2021;111(10):938–41.

6 Zahran FM, Ardawi MSM, Al-Fayez SF. Carboxyhemoglobin concentrations in smokers of sheesha and cigarettes in Saudi Arabia. Br Med J. 1985;291(6511):1768–70.

7 Maziak W. The waterpipe: A new way of hooking youth on tobacco. Am J Addict. 2014;23(2):103–7.

8 Dar-Odeh NS, Bakri FG, Al-Omiri MK, Al-Mashni HM, Eimar HA, Khraisat AS, et al. Narghile (water pipe) smoking among university students in Jordan: prevalence, pattern and beliefs. Harm Reduct J. 2010;7:10–6.

9 Primack BA, Shensa A, Kim KH, Carroll MV, Hoban MT, Leino EV, et al. Waterpipe smoking among U.S. University students. Nicotine Tob Res. 2013;15(1):29–35.

10 Zahran F, Yousef AA, Baig MH, Baig ALI. A study of carboxyhaemoglobin levels of cigarette and sheesha smokers in Saudi Arabia. Am J Public Health. 1982;72(7):722–4.

11 Raaijmakers NJ, Bokma AHF, Eggen GG, Prins G, Alsma J. An unhealthy blush-secondary erythrocytosis due to waterpipe smoking. Neth J Med. 2020;78(4):202–5.

12 Bonadies N, Tichelli A, Rovó A. When water does not clear the smut from the smoke. BMJ Case Rep. 2013;2013:bcr2013200665.

13 Eichhorn L, Michaelis D, Kemmerer M, Jüttner B, Tetzlaff K. Carbon monoxide poisoning from waterpipe smoking: a retrospective cohort study. Clin Toxicol. 2018;56(4):264–72.

14 Anaqrah H, McCabe DJ. Severe chronic carboxyhemoglobinemia and polycythemia due to smoking hookah. Am J Emerg Med. 2022;55:226.e1–2.