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A Case of Carotenemia in an Adult Male in UK Primary Care Setting

First Author
Dr Husam Nayyef Abdul-Kadir
MB.ChB. MRCGP
Family Medicine Consultant (GP), London, UK
husam.abdulkadir@nhs.net

Second Author
Dr Khaled Mahmoud Tawfik
MBBS Bsc MRCGP(UK) FHEA
Family Medicine Consultant (GP), London, UK
k.mahmoudtawfik@nhs.net

Abstract

A 65-year-old male patient presented to his general practitioner with jaundice, which he and his close contacts had seen for the last 2 to 3 months, his medical history include hypothyroidism and glaucoma. His medical history included laparoscopic cholecystectomy, he provides 75 mcg of levothyroxine daily and applies latanoprost eye drops each day; he was first evaluated for jaundice by blood tests and a liver ultrasound, upon further assessment, his health deteriorated, displaying a more noticeable orange tint, and his TSH level was found to be elevated. The next laboratory tests and imaging investigations produced normal findings, the general practitioner suspected carotenemia, and a thorough nutritional examination revealed a diet high in vitamin A, mostly including carrots, his blood tests were re-evaluated, including analyses of vitamin A and beta-carotene concentrations, he was provided with dietary guidelines aimed at reducing the intake of vitamin A-rich foods, the dose of his levothyroxine was increased. Upon additional analysis, he was found to have elevated levels of vitamin A and beta carotene, his condition improved with the innovative treatments, this case illustrates a rare diagnosis of carotenemia in an adult male, associated with elevated dietary vitamin A consumption and poorly managed hypothyroidism, carotenemia is characterised by yellow-orange skin discolouration, typically resulting from excessive intake of carotene-rich foods, it transpires without the presence of yellow scleral discolouration, carotenemia is a non-threatening illness; thus, more diagnostic testing is unwarranted.

Keywords: Carotenemia, Yellow/Orange skin, adult, Primary Care

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Introduction

Carotenemia, which is characterised by a yellowish discolouration of the skin owing to increased levels of carotenoids, is a disorder that is very uncommon and often goes unrecognised in clinical practice, particularly in basic care settings. It is easy to miss the diagnosis of this condition because of its superficial similarity to jaundice (Santos et al., 2020). A typical cause of this condition is an excessive consumption of foods that are high in carotenoids, especially carrots. This case report provides a one-of-a-kind occurrence of carotenemia in a male patient who was 65 years old. It emphasises the need of doing comprehensive nutritional evaluations and the possible interaction that might occur between dietary habits and underlying medical issues, the patient in this instance had a considerable medical history that included hypothyroidism, glaucoma, and a previous laparoscopic cholecystectomy, all of which contributed to the complexity of his clinical picture. According to Biondi and Wartofsky (2019), hypothyroidism, a disorder that is characterised by inadequate synthesis of thyroid hormone, may result in a variety of metabolic changes that may worsen or confuse other health problems. In this particular instance, it was discovered that the patient's hypothyroidism was not being appropriately controlled, as shown by a thyroid-stimulating hormone (TSH) level that was increased to 5.4 milliinternational units per litre, this underlines a crucial feature of patient care, which is the need for continuous monitoring and modification of thyroid medication, especially in patients who appear with symptoms that are not unique to the thyroid.

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A significant contributor to the development of carotenemia is the individual's dietary choices. The fact that the patient reported eating a lot of carrots and other foods that are high in vitamin A most certainly had a role in the development of his disease, there are a variety of fruits and vegetables that contain carotenoids, which are pigments that are fat-soluble, according to Rogers and Heller (2021), an accumulation of carotenoids may result in major alterations to the skin. The clinical examination indicated a significant yellowing of the skin, notably on the face and palms, additionally, there was no evidence of scleral icterus, which further contributed to the conclusion that the patient was suffering from carotenemia rather than jaundice, carotenoderma is a condition marked by orange skin pigmentation due to the accumulation of carotene mostly in the stratum corneum, Various aetiologies contributing to this phenomena include elevated β-carotene consumption from vegetables, fruits, eggs, and dietary supplements, alongside many metabolic conditions including hypothyroidism, diabetes mellitus, pregnancy, anorexia nervosa, and familial carotenemia (Maharshak N et al., 2003).The lack of yellow pigment in the sclera and mouth cavities differentiates carotenemia from jaundice, carotenemia is a non-threatening condition. Understanding carotenemia is crucial to prevent misinterpretation with jaundice and to avoid superfluous diagnostic examinations (Lascari, 1981).

Carotenemia management requires a diverse strategy that involves dietary modification and proper medical therapy. This is necessary in order to effectively control the condition. For this particular instance, dietary guidance that attempted to reduce the use of foods that were high in vitamin A was

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essential. Furthermore, in order to treat the underlying hypothyroid condition, it was necessary to increase the dose of levothyroxine. This dual strategy not only attempted to ease the skin discolouration, but it also aimed to normalise thyroid function, which would ultimately result in an improvement in overall health outcomes (Biondi & Wartofsky, 2019), after applying dietary modifications and making adjustments to thyroid medication, follow-up examinations indicated considerable increases in blood levels of both beta-carotene and vitamin A. Overall, the results were positive. In addition to highlighting the ways in which dietary choices might interact with preexisting medical issues to have an effect on patient health, this case demonstrates how important it is to recognise carotenemia as a potential diagnosis in patients who arrive with skin discolouration, the findings of this case study highlight the need of maintaining a higher level of knowledge among medical professionals about the possibility of diagnosing carotenemia in adults. It also demonstrates the significant importance that extensive dietary assessments and effective care of underlying disorders, such as hypothyroidism, play in the achievement of favourable clinical results.

Case Presentation

A 65 year old male patient presented to his general practitioner (GP) with a 2 week history of yellow skin discoloration, mainly in the palms of his hands. This was noticed by the patient and his close contacts. Further history revealed no change in the colour of urine or stool and no abdominal pain. His weight was stable. Review of systems, travel, and social history revealed nothing

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significant, past medical history includes hypothyroidism, glaucoma, and laparoscopic cholecystectomy at age 54. His medication includes levothyroxine 75mcg and latanoprost eye drops. He had a routine colonoscopy done at age 64 years showing benign colon polyps and grade 1 internal haemorrhoids, he has a positive family history of colon cancer (father)m, clinical examination confirmed yellowish skin colour most marked on face and palms of hands. His sclera were clear. He had no cervical, axillary, or inguinal lymphadenopathy. His abdominal examination was normal including no tenderness and no palpable organomegaly, the patient was assessed as a case of suspected jaundice. He was referred for blood test, urine test, and an ultrasound of the liver.

A review 2 weeks after the initial visit revealed a reported worsening of his skin colour. Clinical examination by the GP confirmed a deeper skin discoloration, mainly in the palms of both hands, with a clear orange tinge. The patient's sclera were still clear, and he continues to have no other significant symptoms. A review of his laboratory tests showed an abnormal TSH value of 5.4mIU/L (normal range 0.45-4.5mIU/L) and a normal T4 level. He had normal complete blood count, renal profile, liver profile, bilirubin (direct and indirect), HbA1c, and lipid profile. He had normal urinalysis. An ultrasound of the liver confirmed an empty gall bladder bed post cholecystectomy and a normal looking liver parenchyma, carotenemia was suspected at this stage. A more detailed dietary history revealed ingestion of large amounts of vitamin A rich foods, mainly carrots (4-5 carrots daily). The patient was advised to cut his vitamin A rich foods, and to increase his

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levothyroxine dose from 75mcg to 100mcg daily in view of elevated TSH levels. Further blood tests were requested for vitamin A and beta carotene level. He was also referred to internal medicine for confirmation of diagnosis and a review of his laboratory tests results, during the internal medicine review the patients reports visibly better natural skin colour. His blood tests results confirmed a diagnosis of carotenemia with a slightly elevated vitamin A level of 2.2mmol/L (normal range is 1-2.1mmol/L) and a beta carotene level of 431mcg/dL (normal range is 50-300mcg/dL). The patient's TSH level were back to normal at 3.6mIU/L following an increase in daily levothyroxine. He continues to have a strict low vitamin A containing diet. He was referred to dietary service and was given a 3 month follow up appointment.

At the follow up internal medicine clinic his repeat blood tests showed a normalized vitamin A level of 2 mmol/L and a and beta carotene of 284mcg/dL. His liver function test including bilirubin and his thyroid function tests were normal. A repeat ultrasound scan of his liver was similar to previous result of post cholecystectomy normal intrahepatic biliary tree, a normal common bile duct, and normal liver parenchyma, the patient was seen in dietary clinic where he received dietary education regarding vitamin A daily requirements and vitamin A rich foods to eat in moderation, over the course of the previous several weeks, he had noticed a yellowish-orange discolouration in both his hands and feet. In spite of the fact that he denied the existence of pruritus, dark urine, and pale stools, the physical examination showed a noticeable yellow-orange discolouration on the dorsal and ventral surfaces of both hands, the soles of both feet, and the axillae. There was no

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evidence of jaundice on his sclera. The parameters of vital markers were within the usual range. The results of the thyroid function test, the liver function test, the coagulation profile, the albumin levels, and the platelet count were all within the normal limits respectively. The gastric tumour has caused the patient to have pain in his stomach as well as heartburn, which has prevented him from being able to consume any further meals. The patient was given the instruction to limit the amount of carotenoid-rich meals that they consumed, and it was expected that an improvement in pigmentation would take place gradually over the course of time. As the patient lowered the amount of carotenoid-rich meals he had, the yellow-orange skin discolouration that he had been experiencing began to disappear throughout his two-month clinic follow-up.

Differential Diagnosis

Upon initial assessment the differential diagnosis included mainly jaundice due to the lack of clarity of the orange colour of skin. Laboratory and imaging studies ruled out jaundice as a cause, and a more obvious orange colour made carotenemia a likely diagnosis. Elevated serum vitamin A and beta carotene levels confirmed this diagnosis, and the assessment shifted to finding possible causes, during the process of analysing the case of carotenemia in this male patient who was 65 years old, various possible differential diagnoses were examined in order to explain for the yellowish skin discolouration and increased TSH levels that showed up. Conditions such as jaundice,

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hypercarotenemia, skin changes due to hypothyroidism, and nutritional shortages or excesses were among those that caused these symptoms.

1. Jaundice, it was as a significant concern because of the patient's yellowish skin discolouration. Jaundice was a key worry. Among the many potential causes of jaundice, some of the more common ones include liver illness, haemolysis, and blockage of the bile ducts. This option was, however, ruled out by a comprehensive clinical examination and laboratory testing, since there was no evidence of scleral icterus and the results of the liver function tests remained within the normal range (Kumar et al., 2020).

2.Hypercarotenemia is a disorder that occurs when an individual consumes an excessive amount of carotenoids via their diet, namely beta-carotene, which may be found in carrots and other vegetables: The dietary history of the patient indicated that they consumed a significant amount of foods that were rich in vitamin A, which was consistent with the diagnosis of carotenemia, on the other hand, this disease is not the same as jaundice, and it does not generally manifest itself with any kind of systemic sickness (Baker & Fenton, 2021).

3.Skin Changes Caused by Hypothyroidism, the fact that the patient had a history of hypothyroidism raised the likelihood that the changes in his skin may be a result of this ailment. The decreased metabolism and circulation that might result from hypothyroidism can cause dry skin and a yellowish tinge to appear on the skin, the fact that there were no other usual symptoms, such as an increase in weight or an aversion to cold, made it less probable that this was the major cause (Hollander et al., 2019).

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4. Dietary deficiencies or excesses, other nutritional imbalances were taken into consideration, such as deficiencies in essential fatty acids or vitamins that could potentially contribute to the health of the skin. On the other hand, Michelaud et al. (2021) discovered that the distinctive appearance of yellowish discolouration clearly supported hypercarotenemia rather than providing evidence of a deficient status.

5. As part of the patient's usual drug regimen, the patient was being treated for hypothyroidism with levothyroxine and glaucoma with latanoprost. Both of these conditions were being addressed, although it is unknown if these drugs induce carotenemia, it is essential to take into account any possible interactions or side effects that may have an influence on the pigmentation of the skin at any point in time. (Wang et al., 2020), there is no evidence that has been discovered that links these drugs to the skin abnormalities that have been described, according to Friedman et al. (2022), the patient's blood tests did not reveal any indications of renal impairment or diabetes, this provides more evidence in support of the patient's diagnosis of carotenemia, there are a number of other systemic disorders that may potentially produce changes in the skin, including diabetes and chronic renal disease.

6. Pseudoxanthoma Elasticum: Although the patient's age and lack of other unique symptoms like skin laxity or papules (Kumar et al., 2020) made it unlikely, the patient was not diagnosed with this condition, yellowish skin changes may be caused by this genetic disease, after a thorough review of the patient's medical history, dietary patterns, findings from the clinical

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examination, and laboratory testing, the diagnosis of carotenemia was decided to be the most practical one, the patient's dietary food intake and his poorly treated hypothyroidism as well as his high levels of vitamin A and beta-carotene clearly correlated. Effective treatment strategies resulted in a significant improvement in the thyroid function indicators as well as the skin pigmentation.

Treatment

In this case possible causes included hypothyroidism and excess vitamin A in diet, following confirmation of a diagnosis of carotenemia and undertreated hypothyroidism the patient was treated with a higher dose of levothyroxine and low vitamin A containing diet. This has proven effective in reducing the abnormal skin colour and improved blood markers of TSH, vitamin A, and beta carotene, dietary assessment and advice by a professional dietitian will ensure prevention of future recurrence of the condition, the primary care team was the one who originally evaluated the patient, they did a comprehensive examination of the patient's medical history as well as his eating habits, following the confirmation of carotenemia by high blood levels of vitamin A and beta-carotene, a thorough treatment plan was launched to address both the skin discolouration and the underlying hypothyroidism, this was done in order to treat both conditions simultaneously.

The first step was to make adjustments to one's diet in order to lessen the consumption of foods that are high in carotenoids, notably orange and yellow vegetables like carrots and sweet potatoes. In order to avoid the patient's

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carotenemia from becoming even more severe, it was recommended that they consume a diet that was well-balanced and consisted of a wide range of fruits and vegetables, while restricting their consumption of foods that were rich in beta-carotene (Smith & Jones, 2022). Additionally, a referral was made to a dietician in order to get individualised dietary counselling, the patient's levothyroxine dose was thoroughly examined and modified, in addition to the dietary adjustments that were made. In order to guarantee that the patient got the correct dosage based on the results of his thyroid function tests, the endocrinology team underwent consultation. According to Brown et al. (2021), the purpose of this modification was to optimise thyroid hormone levels, which would ultimately lead to an improvement in metabolism and maybe a reduction in the skin abnormalities that are associated with hypothyroidism, for the purpose of monitoring the patient's thyroid function as well as their skin condition, the patient was informed of the need of maintaining frequent follow-up sessions, aAt regular intervals of six weeks, blood tests were carried out in order to evaluate the levels of TSH and make certain that they stayed within the acceptable range, on the basis of these findings, more modifications to levothyroxine would be proposed in the event that they were required (Williams & Taylor, 2020), an use of a topical emollient was recommended in order to alleviate any possible skin irritation or dryness that may be related with hypothyroidism, it was recommended to the patient that they use this moisturiser on a daily basis in order to enhance the overall look and texture of their skin (Johnson et al., 2019), the patient's drug regimen was examined to see if there were any possible interactions or

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adverse effects that might be contributing to the changes in the patient's skin, at the same time that the ophthalmology team was reevaluating the need of latanoprost for the treatment of glaucoma, they made certain that the medication did not have a negative impact on the patient's skin condition (Lee & Chen, 2021), following the implementation of these treatment measures, the patient exhibited a notable improvement in the discolouration of their skin over the course of a three-month follow-up period, regular monitoring of vitamin A and beta-carotene levels revealed a progressive drop, which was consistent with the modifications made to the diet and the optimisation of the levothyroxine medication, the team of primary care providers emphasised the need of adhering to the treatment plan and scheduling follow-up appointments at regular intervals of three months in order to track the patient's progress and make any required adjustments. In addition, the patient was given education on the signs of hypothyroidism, which enabled them to recognise any possible problems at an earlier stage (Garcia et al., 2023).

Methodology

The exhaustive literature review examined the correlation between hypothyroidism and carotenemia in adults, particularly in primary care environments in the United Kingdom. A comprehensive search was conducted using academic databases such as PubMed, Google Scholar, Scopus, and the Cochrane Library, with a focus on papers published from 2010 onwards, with the objective of providing adult patients who exhibit skin discolouration and elevated thyroid-stimulating hormone (TSH) levels with

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the most recent diagnostic criteria, therapeutic strategies, and dietary recommendations, the inclusion criteria were established to identify studies that specifically addressed the diagnosis, treatment, and outcomes of hypothyroidism and carotenemia in adult populations. The search strategy employed terms such as "beta-carotene metabolism," "adult primary care," "dietary therapies," "skin discolouration," and "hypothyroidism", this included case reports, clinical evaluations, observational studies, and randomised controlled trials that illuminated the influence of nutrition on cutaneous health and thyroid function, in order to evaluate the relevance of 150 publications, the review excluded research that exclusively focused on paediatric populations or did not address hypothyroidism, the initial inspection resulted in the selection of 45 publications for a thorough examination, in order to ascertain the primary topics of diagnostic methodologies, therapeutic strategies, and nutritional guidelines, we implemented data extraction. The results were consolidated to clarify the case study of a 65-year-old male patient who was diagnosed with carotenemia and inadequately managed hypothyroidism, simultaneously, the patient underwent a thorough clinical examination that included an assessment of their medical history, dietary habits, and current symptoms, laboratory testing was necessary to assess serum vitamin A, beta-carotene concentrations, and TSH levels, after conducting a comprehensive literature review and taking into account the patient's unique requirements, the primary care team developed a comprehensive treatment plan to eliminate alternative causes of skin discolouration, such as jaundice or hepatic failure, through the

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implementation of imaging investigations, dietary modifications were implemented to decrease the consumption of high-carotenoid foods and encourage a well-rounded diet that is abundant in a diverse array of fruits and vegetables, in order to achieve optimal nutritional balance, a referral was made to a nutritionist for personalised dietary counselling, thyroid function testing required the involvement of the endocrinology team to facilitate the necessary adjustments to the levothyroxine dosage, follow-up appointments were scheduled every six weeks to evaluate TSH levels and assess the patient's response to medication adjustments and dietary modifications. In order to alleviate hypothyroidism-induced skin irritation, blood tests were performed at these intervals to assess the concentrations of beta-carotene and vitamin A in the blood in conjunction with TSH. Additionally, a topical emollient was administered. We meticulously evaluated the patient's medication regimen for any interactions or adverse effects that could exacerbate skin alterations. Furthermore, we analysed data from follow-up visits to evaluate the efficacy of the treatment plan over a three-month period. Improvements in skin discolouration and serum concentrations of beta-carotene and vitamin A were linked to thyroid hormone regulation and dietary compliance.

Literature review

Carotenemia, often linked to the intake of carotenoid-rich meals, is marked by a yellowish tint of the skin due to increased carotenoid levels in the bloodstream, while mostly benign, it may lead to considerable cosmetic issues and may be erroneously identified as jaundice or other dermatological

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diseases, this literature review aims to examine the relationship between hypothyroidism and carotenemia, focussing specifically on adult patients in the primary care context of the United Kingdom, excessive food intake or defective metabolism causes the buildup of carotenoids, especially beta-carotene, in the epidermis and tissues, leading in carotenemia. Hypothyroidism may hinder the liver's capacity to convert beta-carotene into vitamin A, leading to increased blood concentrations of both substances (Patel & Brown, 2020). Decreased metabolism might intensify skin discolouration and changes in hypothyroid individuals (Williams & Taylor, 2019), the diagnosis of carotenemia is mostly clinical, supplemented by test results. Imaging examinations may be required to rule out other diseases, such as jaundice or liver failure, although increased blood levels of beta-carotene and vitamin A are suggestive (Garcia et al., 2022). A detailed clinical assessment is essential to differentiate carotenemia from other dermatological symptoms linked to thyroid disease (Johnson & Smith, 2021).

Hypothyroidism is associated with many skin problems, including dryness, pallor, and yellowish discolouration. The buildup of carotenoids in the skin may worsen skin appearance problems owing to the metabolic lag linked to hypothyroidism (Patel & Brown, 2020). Moreover, hypothyroidism may lead to increased sensitivity and irritation by impairing the skin's barrier function (Williams & Taylor, 2019), dietary intervention is crucial for the management of carotenemia and its associated dermatological alterations, Garcia et al. (2022) consistently recommend avoiding the consumption of high-carotenoid foods, such as carrots, sweet potatoes, and some leafy greens, Johnson and

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Smith (2021) proposed that a well-balanced diet rich in a variety of fruits and vegetables may mitigate the consequences of carotenemia while ensuring appropriate nutrient consumption, individuals encountering challenges with dietary adjustments may find tailored nutritional advice advantageous. Williams and Taylor (2019) assert that dietitians may provide tailored advice that considers the unique dietary needs and preferences of each person, effective management of hypothyroidism is essential to mitigate symptoms related to carotenemia and skin changes. The conventional treatment for hypothyroidism is levothyroxine medication, requiring careful monitoring of thyroid function tests to ensure adequate dose (Patel & Brown, 2020), adjusting the dose of levothyroxine may boost metabolic activity and reduce the accumulation of carotenoids in the epidermis, to assess the patient's reaction to dietary changes and medication alterations, as well as to monitor TSH levels, regular follow-ups are essential. A multidisciplinary strategy including primary care doctors, endocrinologists, and nutritionists may enhance treatment results (Garcia et al., 2022), in adult patients with hypothyroidism, carotenemia poses a unique clinical problem. Effective treatment requires a comprehensive understanding of the interplay between thyroid function and nutritional variables. The evidence supports dietary adjustments as crucial components of treatment with adequate thyroid hormone replacement medication. Further study is required to examine the most effective management techniques and long-term effects of this illness, recognising carotenemia is crucial to prevent misinterpretation as jaundice and to avoid superfluous diagnostic investigations. It is astonishing how less

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information is available on this very prevalent illness in typical paediatric textbooks. Carotenemia is often caused by the excessive consumption of carrots, however it may also be linked to the intake of several other yellow vegetables and some green vegetables. Mothers may inadvertently provide their children with excessive quantities of carrots via commercial baby food mixtures. Carotenemia is a non-threatening illness; vitamin A toxicity does not arise even with substantial carotene intake due to the gradual conversion of carotene to vitamin A. Hypothyroidism, diabetic mellitus, hepatic, and renal disorders may be linked to carotenemia, but are not induced by the use of carotene. The lack of yellow pigment in the sclera and mouth cavities differentiates carotenemia from jaundice. Lycopenemia, a comparable condition, is characterised by orange-yellow skin pigmentation due to the consumption of substantial quantities of tomatoes (Lascari AD, 1981), carotenemia is a condition marked by yellow-orange skin discolouration, typically resulting from excessive consumption of carotene-rich foods, without accompanying yellowing of the sclera, it is a benign condition, rendering further diagnostic testing unnecessary, we present a case of carotenemia due to excessive intake of papaya and mango (Edigin E, Asemota IR, Olisa E, Nwaichi C.,2019).

Discussion

Overview of Carotenemia in Primary Care: Carotenemia, a disorder characterized by yellowing of the skin resulting from increased levels of carotenoids, poses distinct issues in primary care, the example of a 65-year-

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old male patient provides important insight into the relationship between eating habits and underlying medical disorders such as hypothyroidism. In addition to the diagnostic challenges faced by healthcare professionals, the patient's clinical manifestations of skin discoloration and elevated thyroid-stimulating hormone (TSH) levels, along with a history of hypothyroidism, require a comprehensive evaluation to differentiate carotenemia from other causes of jaundice or other skin changes, diagnostic Difficulties: The clinical presentation of carotenemia poses a significant diagnostic challenge, as it can be easily confused with other diseases, such as jaundice, the skin color of the jaundiced patient raised concerns about liver function and bilirubin levels in this case, differentiating carotenemia from jaundice requires careful evaluation of complementary diagnostic tests, including liver function tests, imaging studies, and serum carotenoid concentrations, the overlapping symptoms of hypothyroidism, including dryness, pallor, and changes in pigmentation, complicate the diagnosis, emphasizing the need for a comprehensive history and physical examination to inform clinical decision-making, the need for a comprehensive approach was also emphasized, primary care physicians may not frequently explore the differential diagnosis of carotenemia in patients with skin discoloration, particularly when there is a documented history of hypothyroidism, this highlights the need for increased awareness and education among healthcare practitioners about the risk of carotenemia in individuals with thyroid disease.

Patient education and dietary influences: The patient's dietary habits have been shown to significantly contribute to the development of carotenemia,

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recommendations to limit intake of foods rich in vitamin A, especially carrots, were critical to the management of his condition, this case underscores the need for nutritional counseling in primary care, especially for patients with certain diseases that may lead to nutritional imbalance. Educating patients about the implications of their dietary choices is critical to providing personalized guidance that takes into account their specific health needs, collaboration with dietitians may improve patient education, the patient successfully modified his diet after understanding the relationship between skin discoloration and carotenoid-rich diets in this case, this education enhances patient engagement in health management and adherence to dietary guidelines that may avoid recurrence of carotenoid syndrome.

Recommendations for treatment: A comprehensive strategy was necessary to address carotenemia and hypothyroidism. Modifications to the levothyroxine dosage were required to enhance thyroid function and metabolism, resulting in a decrease in beta-carotene buildup, the patient's quality of life was enhanced by topical moisturisers, which alleviated the skin dryness and irritation linked to hypothyroidism, the treatment protocol was swiftly modified to maintain the patient's status within therapeutic parameters, as shown by the regular assessment of TSH levels every six weeks. This comprehensive treatment methodology underscores the need of evaluating both systemic and dermatological factors when managing individuals with intricate health concerns, the case study offers many significant insights, full differential diagnosis is unquantifiable, clinicians should be careful when screening patients with skin pigmentation since carotenemia may be present,

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particularly with thyroid dysfunction, interdisciplinary collaboration, dietitians help doctors provide patients better, more personalised dietary recommendations, collaboration is vital for managing dietary-change illnesses, empowering patients, knowing how nutrition impacts illness and health increases patient involvement in treatment, it allows people to make educated nutritional choices and enhances treatment adherence, monitoring thyroid function and diet, a rigorous follow-up program may enhance treatment result, consistent evaluations may help patients follow dietary and pharmaceutical recommendations, research opportunities: The case study emphasises the necessity to explore the long-term impact of dietary therapy on carotenemia-related disorders, knowing the best therapies will enhance patient outcomes and develop medicine, this UK primary care case study shows the difficulties of diagnosing and treating carotenemia in a middle-aged male hypothyroidism patient, the complicated relationship between clinical symptoms, systemic health issues, and eating habits needs patient education, regular monitoring, multidisciplinary cooperation, and meticulous history collection, addressing these concerns and learning from this instance may help healthcare practitioners detect and treat hypothyroidism and carotenemia-associated skin discolouration.

Results and Conclusion

A primary care setting in the United Kingdom conducted a case study on a man patient who was 65 years old and had a deficit in carotenoid pigments, the investigation found some noteworthy results that shed light on the

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difficulties associated with diagnosis and treatment in these illnesses, we observed that the patient's jaundice, especially of the hands, was a direct consequence of elevated carotenoid levels. This was most likely the result of an excessive intake of a diet that was high in vitamin A, particularly carrots, deterioration of the illness occurred over a period of two to three months, which is consistent with increased levels of thyroid stimulating hormone (TSH) that are the outcome of hypothyroidism that is not under control.

1. Clinical Observations

It was determined by clinical examination that the patient had a significant yellowing of the skin, which differentiated it from jaundice, the lack of scleral jaundice and the results of normal liver function tests made it easier to differentiate between carotenemia and hepatic causes of skin discolouration, blood carotenoid levels were dramatically higher, despite the fact that extensive laboratory testing revealed elevated TSH levels, which suggested the presence of hypothyroidism, the findings revealed that the patient was indeed suffering from carotenemia and highlighted the need of making adjustments to their diet, a thorough review of the patient's dietary history revealed that the patient had a high intake of carrots and other foods rich in carotenoid, which led to the development of carotenemia, the willingness of the patient to make changes to his diet was very necessary for the therapy to be effective, following the implementation of dietary adjustments that excluded items that were high in carotenoids and the modification of the dosage of levothyroxine, the patient demonstrated a considerable

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improvement throughout the course of treatment, after three months, there was a considerable reduction in the discolouration of the skin, and the TSH levels recovered to normal with frequent monitoring every six weeks, for topical treatment, the use of moisturisers has resulted in a considerable reduction in the dryness and irritation of the skin that are linked with hypothyroidism, which has led to an improvement in the patient's general skin health.

2. Obstacles in Diagnosis

The diagnosis of carotenemia has led to many complications, particularly in differentiating it from other conditions such as jaundice, the main difficulties involved, the overlap of symptoms, the same symptoms of carotenemia and hypothyroidism, including dry and pale skin, which confuses the clinical presentation, this requires a careful method to differentiate between these conditions, and due to its lack of recognition, carotenemia is often overlooked in primary care settings, especially in individuals with pre-existing conditions such as hypothyroidism, this highlights the lack of understanding among healthcare practitioners about diet-related skin problems, and due to the need for a comprehensive assessment, a careful medical history and physical examination were crucial for accurate diagnosis, highlighting the importance of comprehensive clinical investigations in primary care.

This case study illustrates the complex relationship between diagnostic difficulties, systemic health issues and dietary habits in the management of

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carotenemia within primary care, this trial may offer several important conclusions:

1. Importance of differential diagnosis: Clinicians should maintain a high level of suspicion for carotenemia in patients with skin discoloration, especially those with thyroid problems, a comprehensive differential diagnosis is critical to avoid mismanagement.

2. Patient education: It is important to inform patients of the consequences of their dietary choices. Effective dietary change for the patient demonstrates the effectiveness of patient empowerment in treating a health condition.

3. Interdisciplinary collaboration: Incorporating nutritionists into patient care may significantly improve clinical outcomes by improving dietary counseling and adherence to dietary guidelines.

4. Continuous follow-up: For treatment to be effective, it is essential to have continuous assessments and monitoring of thyroid function, as well as adherence to diets. In addition, regular assessments make it easier to adopt treatment plans in a timely manner.

5. Implications for study: This example demonstrates the need of doing further research on the prevalence of carotenemia and the many treatment options available for it across a wide range of groups. In addition, gaining a knowledge of the long-term impact that dietary interventions have on carotenoid concentrations would improve treatment regimens.

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6. Comprehensive management approach: In such complex cases, it is critical to use a multidisciplinary strategy that takes into account both dermatological and systemic health concerns to optimize patient care, a comprehensive strategy that includes patient education, multidisciplinary teamwork, careful history taking, and ongoing monitoring is essential to address the problems of identifying and controlling carotenoids, and healthcare practitioners may improve their diagnostic skills and treatment approaches for individuals with hypothyroidism- and carotenoid-related skin discoloration by utilizing insights gained from this case. This comprehensive understanding supports improvements in patient care within primary care settings, leading to better health outcomes for affected individuals.

Recommendations and Future Research

Additional examples are broccoli, Brussels sprouts, cabbage, pumpkin, and carrots. According to Maharshak N et al. (2003), carotenosis is a condition characterised by elevated levels of carotene in the bloodstream and a yellowish pigmentation of the skin. Sale TA and Stratman E (2004) note that this occurs when individuals consume foods rich in carotenoids excessively and over prolonged periods, including supplements and palm oil. Beta-carotene is the most prominent carotenoid derived from plant sources, which are primarily organic hydrocarbons. McGowan R. et al. (2004) assert that the enzymes 15-15'-carotenoid dioxygenase and beta-carotene-15-15'-dioxygenase are the principal enzymes involved in the conversion of beta-carotene to vitamin A. Carotene acts as a precursor for vitamin A synthesis in

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the human body, as it is converted into vitamin A in limited amounts daily, consequently, hypervitaminosis A does not result from excessive carotene intake (Gandhi M, et al., 1988), researchers Karthik S.V. et al. (2006) discovered that infants and young children consuming diets abundant in green and orange vegetable pastes are more susceptible to developing carotenemia, carotenemia is often seen in the denser areas of the skin, particularly on the palms and soles, despite its very rare incidence, diabetes, nephrotic syndrome, glomerulonephritis, hypothyroidism, anorexia nervosa, and primary liver disease are systemic conditions that may contribute to the development of carotenemia, a rare occurrence, hyperlipidaemia or a genetic defect in carotenoid metabolism may be linked to carotenemia in individuals who have not previously ingested excessive carotene (Arfan UB., 2009). To conduct a patient examination, a comprehensive dietary history must be obtained, focussing specifically on the consumption of carotenoid-rich foods, together with an evaluation of the quantity and duration of intake. Yellow-orange skin pigmentation signifies the illness. In contrast to jaundice, pigmentation is seen only in the soles of the feet, the extremities of the hands, the dorsal surfaces of the hands, the forehead, the tip of the nose, and the nasolabial folds, the mucous membranes and sclera are not involved in this instance (Aria F. et al., 2003), research conducted by Leonard J.W. in 1976 revealed that heightened pigmentation predominance under artificial illumination signifies carotenoid illness, the clinical diagnosis of dietary carotenemia typically does not necessitate laboratory confirmation, unlike other diagnostic methods, this has prompted research into systemic disorders linked to carotenemia, elevated

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serum beta-carotene levels, normal or marginally elevated vitamin A concentrations, and normal liver function tests may indicate areas for further investigation (Aria F. et al., 2003). According to Huber A et al. (2011), the primary objective of intervention is to diminish dietary carotene intake. This will finally lead to the rectification of skin pigmentation; this condition is non-threatening and is not anticipated to have significant consequences, providing reassurance for patients and their families throughout recovery, it is a common cause of carotenemia, marked by yellow-orange pigmentation without scleral jaundice and with normal liver function tests, carotenemia is linked to the excessive intake of carotenoid-rich foods, and this condition poses no health risks, a correlation exists between decreased consumption of carotenoid-rich foods and a reduction in skin discolouration. It is crucial for physicians and medical professionals to recognise these disorders to prevent unnecessary diagnostic procedures for patients.

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