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Case Report Open Access

Chronic Interstitial Nephritis Induced by Long-Term Topical Application of Hair Dye

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Abstract

We provide a patient, habitually used a hair dye contained P-araphenylenediamine once every month for almost six years, who presents elevated creatinine and proteinuria and renal interstitial fibrosis by renal biopsy. Hair dye is widely used all over the world. There have been some literatures about hair dye induced acute kidney injury, but few about the topical application of it can induce chronic interstitial fibrosis. In view of the persistent usage of small dosage of hair dye can cause chronic kidney disease, it is indeed necessary for people to pay attention to the side effect of hair dye.

Keywords: Chronic interstitial nephritis; Hair dye; Prednisone; P-paraphenylenediamine; P-aminophenol

Introduction

Hair dye containing P-paraphenylenediamine and P-aminophenol is widely used for hair coloration and tattooing on the skin all over the world, and the related toxicity has also been reported in the recent years. Some of these reports concern about acute kidney failure caused by hair dye, while others show the relationship between hair dye and tumors, especially the hematologic malignancies, such as lymphoma, multiple myeloma and leukemia, but few literatures mention the chronic interstitial nephritis induced by hair dye, especially the topical usage. The case we provided is about a long-term regularly usage of low dosage of hair dye which caused elevated creatinine, renal interstitial fibrosis and extensive tubular atrophy, and the progression of the disease has been reversed by the discontinuation of hair dye and the application of low does prednisone.

Case Report

A 50-year-old man was admitted to our nephropathy department due to a 3-month history of elevated creatinine and proteinuria which was found in a routine physical examination. He denied the phenomenon of photosensitivity, alopecia, oral ulcers, petechia and arthralgia. His past medical history was unconspicuous and recent medical history was negative for nephrotoxic drugs, antipyretic analgesics drugs and Chinese traditional medicine, but he admitted a 6-year hair dye history for almost once every month. The patient's annual physical examination results were retrospected, and interestingly we found that the creatinine was solwly elevated from 75umol/L to 160umol/L in the recent 5 years.

The physical examination was unremarkable. The laboratory results were listed as follows. 24-hour urinary test showed proteinuria (669.24 mg/day), glucosuria (10.01 mmol/L), raised NAG (22.4 u/L) and elevated β2 microglobulin (22.15 mg/day). The creatinine gradually increased from 160 umol/L to 222 umol/L in three months. The size of the left kidney was 114*46 mm and the right was 101*47 mm under renal ultrasound.

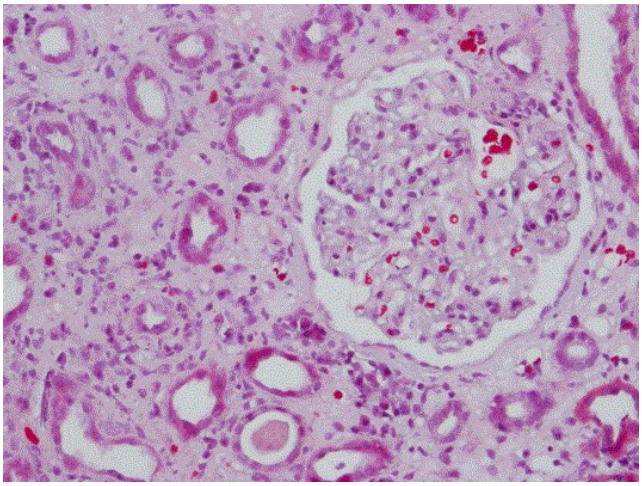

Figure 1: Renal interstitial fibrosis and tubular atrophy of the patient (masson's stain; original magnification, ×400)

The results of blood routine, blood electrolytes, fasting blood glucose, albumin, alanine aminotransferase, aspartate aminotransferase, Complement 3, Complement 4, IgA, IgG, IgM, IgE were all normal, and serum protein electrophoresis was negative for monoclonal. The antineutrophil cytoplastic antibodies, antinuclear antibody, hepatitis B virus, hepatitis C virus and human immunodeficiency virus were all negative. Renal biopsy was performed, showing extensive tubular atrophy, extensive areas of interstitial fibrosis and interstitial inflammation. Immunofluorescences were all negative for IgA, IgG, IgM, Fib, C3 and C1q (Figure 1).

1) Low-to-moderate increase of mesangial cell and mesangial matrix in some glomeruli. 2) Extensive atrophy, brush border exfoliate, basement membrane bareness, red blood cells, exfoliated cells, inflammatory cells and protein casts could be seen in the kidney tubules. 3) Some of the tubular epithelium had granular degeneration and vacuolar degeneration. 4) There were extensive areas of interstitial fibrosis and interstitial inflammation.

Discontinuation of the hair dye usage was announced and oral prednisone was administrated at the dosage of 0.5 mg/kg/day for one month and gradually tapered by 5 mg per 2 weeks until to a dosage of 10 mg and maintain this dose for 6 months. The urinalysis turned normal, and the creatinine decreased to 162 umol/L after two months of the therapy and decreased to 142 umol/L at the end of the third month, 120 umol/L after six months. The urinalysis and blood tests were done every month and revealed in a normal range.

Discussion

The similar clinical and pathologic scenarios can exist in association with a number of diseases of presumably diverse causes.

Causes of chronic interstitial nephritis are presented in Table 1 and the clinical features may range from an abnormal urinalysis to an asymptomatic increase in serum creatinine [1]. Our patient progressed to proteinuria, glucosuria with elevated β2 microglobulin and serum creatinine level after regular usage of hair dye for 6 years. As no evidence of analgesics abusing, metabolic disorders, abnormal immunity, infection, hematologic disorders and obstructive facts could be shown by clinical presentation or renal biopsy, maybe chronic interstitial nephritis is related to the long-term topical application of oxidative hair dye.

Hair dyes, especially the oxidative type, are widely used in many countries. The oxidation hair dyes usually contain primary intermediates (P-paraphenylenediamine and P-aminophenol), couplers and oxidants. The oral application of oxidative hair dyes in some suicidal tendency people has been reported to be associated with lymphoma, multiple myeloma, chronic lymphocytic leukemia and acute leukemia [2,3]. Some studies have reported that P-paraphenylenediamine -containing hair dyes can provoke acute renal failure [4] and P-aminophenol can cause nephrotoxicity through inducing renal oxidative stress [5]. Suliman conducted a retrospective study of 150 cases with P-paraphenylenediamine poisoning, of which 60% developed acute renal failure requiring hemodialysis [6]. Talking of the topical application of P-paraphenylenediamine, Bharali reported that rats painted with different concentration of P-paraphenylenediamine induced a significant decrease in the total RBC count, packed cell volume and hemoglobin level of the peripheral blood which subsequently caused acute renal failure, and extensive tubular necrosis and tubular interstitial inflammation were observed in the renal histological features [7,8].

The underlying mechanism of the nephrotoxicity of hair dyes has not been fully illustrated. We also did the relevant research to investigate it, and our results indicated that both P-paraphenylenediamine and P-aminophenol have proliferation-suppressing, injury- and apoptosis-inducing effects on HK-2 cells by up regulation of caspase-3 mRNA. These effects are time and concentration dependent and become stronger after P-paraphenylenediamine and P-aminophenol are oxidized by H_2O_2 [9].

Therefore, long-term topical application of hair dyes can induce renal interstitial fibrosis, people should be aware of the usage of hair dyes and doctors could query the history of hair dyes usage in patients of chronic kidney disease.

Cause	Example
Drugs and Toxins	Combination analgesics Nonsteroidal antiinflammatory drugs (NSAIDs) Chinese Herbs Lithium Lead Cadmium
Metabolics Disorders	Abnormal uric acid metabolism Hypokalemia Hypercalcemia
Immune Mediated	Sarcoidosis Sjogren's Syndrome Allograft rejection Systemic lupus erythematosus
Infection	Bacterial pyelonephritis Hantavirus Leptospirosis
Hematologic Disorders	Sickle Cell Disease Light chain nephropathy Amyloidosis Myeloma
Obstructive	Tumors Stones Outlet obstruction Vesicoureteral reflux
Miscellaneous	Radiation Nephropathy Progressive glomerular disease Ischemia Hypertension

Table 1: Causes of chronic interstitial nephritis

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