

A Case of Graphite Foreign Body Misdiagnosed as Blue Nevus

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The lead of a pencil is composed of graphite and clay. Although considered as biologically inert for a long time, the lead of a pencil can result in undesirable local pain, pigmentation, abscess formation and graphite foreign body reaction. Therefore, all penetrating injuries caused by a pencil should be carefully assessed and treated in order to remove all pieces of lead from the wound by specialized paramedics or medical doctors. We should be aware that graphite granules embedded in the skin may give rise to clinically alarming delayed reactions. Here we present a 19-year-old woman with a foreign body, the lead of a pencil, misdiagnosed as a blue nevus. (Ann Dermatol (Seoul) 19(4) 166~169, 2007)

Key Words: Lead of a pencil, Graphite foreign body, Granuloma

INTRODUCTION

Injury by a pencil is common and usually trivial¹⁻³. However, several reports indicate that stab injuries caused by pencils can result in undesirable reactions, such as pigmentation, abscess formation, and soft tissue reaction¹⁻⁵. There are only a few previous case reports in literature of pencil core granuloma presenting to dermatologists, plastic surgeons, ophthalmologists, and neurosurgeons as a suspected melanoma, soft tissue sarcoma, hemangioma or abscess¹⁻¹⁰. Here we report a 19-year-old woman with a foreign body, the lead of a pencil, misdiagnosed as a blue nevus.

CASE REPORT

A 19-year old woman presented with an asymptomatic papule of a 10 year duration. On general

inspection, a solitary well-defined 0.5 × 0.3 cm blue papule on the right index finger was observed (Fig. 1A, B). In history taking, she recalled having a trauma with a pencil 10 years ago. She removed the remaining pencil by herself and remembered there was no material left on the stab wound site. A diagnosis of blue nevus was made based on the clinical findings. The punch biopsy contained a piece of material that resembled pencil lead, having a 0.3 cm length (Fig. 1C). Histological evaluation of the punch biopsy demonstrated increased basal pigmentation and small scattered carbon pigments in the dermis (Fig. 2). There was no foreign body reaction or inflammation. Final diagnosis of graphite foreign body was made.

DISCUSSION

In childhood, there can be many accidental traumas by pencils while playing with friends. In most cases, children are afraid of being blamed for the accidents by their parents, so they usually do not notify an adult and leave the wounds as they are. If these pencil lead wounds are left as they are, the lead would remain, possibly resulting in undesirable local pain, pigmentation, graphite foreign

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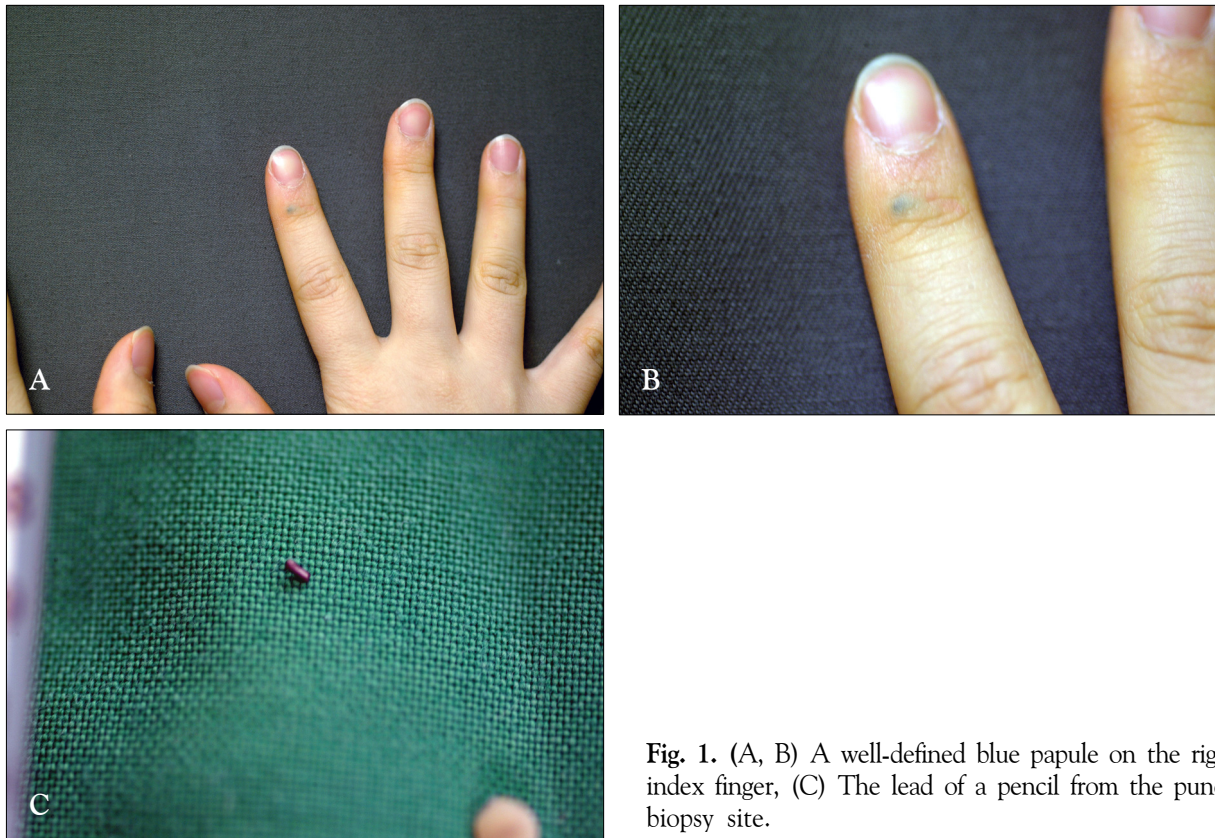


Fig. 1. (A, B) A well-defined blue papule on the right index finger, (C) The lead of a pencil from the punch biopsy site.

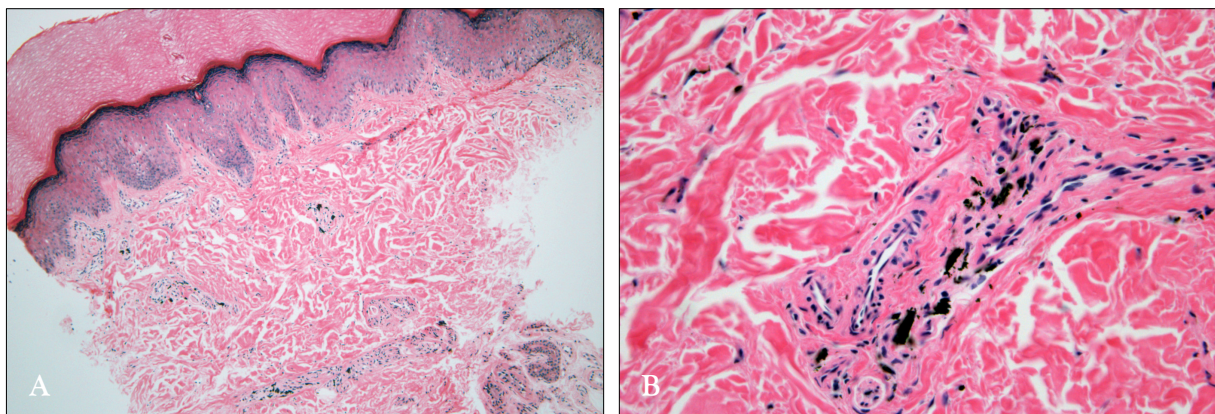


Fig. 2. (A, B) Affected skin biopsy showing increased basal pigmentation and small scattered and fragmented black colored carbon particles in the dermis without obvious inflammatory cell infiltration (H&E, $\times 40$, $\times 200$).

body reaction, and abscess formation^{1,2}. Wounds should carefully be inspected by a school nurse or a medical doctor at the time of the accidental trauma.

Injuries caused by pencils are common and usually trivial. A pencil is a writing or drawing

instrument consisting of a thin stick of lead, usually encased in a thin wood cylinder. The lead of a pencil is composed of graphite (elementary carbon), clay (aluminium silicate), various waxes, and lacquers. Among them, graphite and clay are the main components^{1,2}. Microanalysis of the lead of a

pencil reveals that it is composed of 72.2% carbon, 19.0% oxygen, 5.0% silicon, 3.5% aluminum, and 0.3% magnesium².

Although the lead of a pencil is generally known to induce a non-allergic granulomatous reaction, each of the components could induce a tissue reaction. Silica, a component in clay, can incite an epithelioid granulomatous reaction^{1,2}. Graphite particles may cause a chronic granulomatous reaction in the lung called graphite pneumoconiosis and rarely, graphite foreign body granuloma^{1,2,10,11}. Graphite foreign body granuloma (pencil core granuloma) is characterized by a delayed foreign body reaction against the remaining fragments of pencil lead and at the macroscopic level, it resembles malignant melanoma^{2,12}. The occurrence of pencil core granulomas is rare, only a few case reports have been documented in literature^{1-3,5,6,10,12}. Pencil core granulomas as well as silica granulomas appear to have delayed reactions, with lag periods of 1.5-58 years between injury and granuloma formation^{10,13}. This time lag seems to be the time required for the breakdown of graphite to a critical size as well as dispersal to the interstitium^{2,10}. The mechanism for the formation of this type of granuloma is not clear, but we speculate as follows. The dispersal of graphite particles causes an accumulation of macrophages, and the accumulated macrophages then release various cytokines and growth factors that induce the proliferation of fibroblasts. Finally, ischemia caused by ectatic changes in the blood vessels in the lesion induces tissue fibrosis^{2,10}.

Almost all foreign bodies according to the wound sites can be demonstrated using radiological methods (native picture, ultrasound examination, xeroradiography, CT, MRI)^{14,15}. Stab wound to the spinal cord by a pencil are rare but result in a serious problem such as paraplegia. In spinal penetrating cases, magnetic resonance imaging (MRI) is reported to be useful¹⁶. MRI can show that the foreign body had passed the spinal cord, causing marked indentation of the cord and dura with air along its track^{5,9,17}. In evaluating the patient with a presumed intraorbital foreign body, computerized tomography (CT) is the most valuable tool. CT can provide critical information regarding location and composition. There are several reports of unrecognized intraorbital or periorbital foreign bodies diagnosed as graphite pencil fragments by CT⁶. There can be CT findings such as dense linear fragment due to

the graphite (graphite is surprisingly dense and may be mistaken for a bone fragment or partial volume averaging of a bone margin), chronic osteomyelitis or benign reactive osteitis adjacent to the dense fragment and soft tissue mass surrounding the dense graphite fragment at its center. In investigating any soft-tissue mass, skin biopsy is most important before embarking on definitive treatment⁵.

A pencil is believed to be a harmless and chemically stable material, but several reports indicate that caution must be exercised when treating stab injuries caused by pencils. All penetrating injuries caused by a pencil should be carefully assessed and treated in order to remove all pieces of lead from the wound.

The reported graphite granulomas, all presented many years after the injury. In our case, though there was no specific histological changes at the time of biopsy, there is the possibility of change that if left in the tissue for a longer duration. We should be aware that graphite granules embedded in the skin may give rise to clinically alarming delayed reactions. Here we report a case of graphite foreign body misdiagnosed as blue nevus.

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