Case Report / Olgu Sunumu

DOI: 10.4274/cayd.galenos.2024.76993
J Pediatr Emerg Intensive Care Med

Transoral Penetration Injury of A Wooden Chopstick: A Case Report and Phantom Study

Ahşap Çubuktan Transoral Penetrasyon Yaralanması: Bir Olgu Raporu ve Hayalet Çalışma

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Abstract

This study presents the case of a 3-year-old child who swallowed a wooden chopstick. The surface of the chopstick appeared hyperdense on computed tomography, while the interior was relatively hypodense. To study how wooden chopsticks change their density in the body, we immersed wooden chopsticks in saline for 30 days. The results show a significant increase in the density of the wood over time. This finding underscores the importance of identifying precise injury details for accurate diagnosis and treatment of similar cases. Knowing when the chopstick was swallowed and what material was used will ensure accurate diagnosis and timely treatment.

Keywords: Stab wounds, wood, computed tomography, foreign bodies

Öz

Bu çalışma, ahşap bir çubuk yutan 3 yaşında bir çocuk olgusunu sunmaktadır. Çubuk yüzeyi bilgisayarlı tomografide hiperdens görünürken, iç kısmı nispeten hipodenstidir. Ahşap çubukların vücuttaki yoğunluklarının nasıl değiştiğini incelemek için, ahşap çubukları 30 gün boyunca tuzlu suya batırdık. Sonuçlar, zamanla ahşabın yoğunluğunda önemli bir artış olduğunu gösterdi. Bu bulgu, benzer olguların doğru teşhisi ve tedavisi için kesin yaralanma ayrıntılarının belirlenmesinin önemini vurgulamaktadır. Çubuğun ne zaman yutulduğunun ve hangi malzemeden yapıldığının bilinmesi ile doğru tanı ve zamanında tedavi sağlanabilir.

Anahtar Kelimeler: Kesici delici alet yaralanmaları, ahşap, bilgisayarlı tomografi, yabancı cisimler

Introduction

Chopsticks are slender, elongated utensils typically made of wood, bamboo, or metal. They are used primarily in East Asian cuisines for eating. Walking or playing with a chopstick in the mouth is dangerous and can cause serious complications if it penetrates the deep tissues.[1-4] In penetrating injuries, wood is known to be difficult to detect by radiography because its density is known to be very close to that of air on computed tomography (CT). However, if the chopstick has been in the body for a long time, its density may change.[1-4] In this study, we present the CT findings of a patient with a wooden chopstick buried in the soft palate of the oral cavity and quantitatively assessed the change in density of 10 commercial wooden chopsticks after immersion in physiological saline solution for 30 days.

Case Report

The study protocol was approved by the Institutional Review Board of our hospital (RO2019#32). Informed consent was obtained from the parents for the use of the clinical data and images. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. A 3-year-old boy was playing with a chopstick and fell. The chopstick broke, but the tip could not be found, so he was brought to our hospital. His medical and family history was unremarkable, and his vital signs were normal. On admission, laceration and a small amount of bleeding were noted on the soft palate (Figure 1a). The damaged chopstick was approximately 1 cm shorter than the undamaged chopstick (Figure 1b), but the inner material and coating material could not be specified. Three hours after the injury, a non-contrast CT scan of the soft palate revealed a ring-shaped dense lesion

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Received/Geliş Tarihi: 16.08.2024 **Accepted/Kabul Tarihi:** 01.10.2024

resembling the broken tip of a chopstick (Figure 1c). The average density of the inner material of the chopstick was 43.1 HU. Since the tip of the chopstick did not reach the base of the skull, and no major vascular injury was observed, the chopstick was removed under local anesthesia. The treatment was completed without adverse events, and the patient was discharged without sequelae. We performed a phantom experiment to investigate how the density of wooden chopsticks in the body changes on CT.

Phantom Study

CT imaging findings and temporal changes in the densities of 10 commercial wooden chopsticks were quantitatively evaluated. Table 1 lists the inner and coating materials of the 10 wooden chopsticks and one non-wood acrylic chopstick (#10 on Table 1). Ten wooden chopsticks and one acrylic chopstick were immersed in saline solution, and the change in density of the inner material was quantitatively evaluated by CT. The slice thickness was 2 mm, the X-ray energy was 120 kV, and the X-ray tube current was 500 ms. CT scans were taken immediately after immersion, 3 days, and 30 days later, and the region of interest was placed inside the inner material of each wooden chopstick, and serial changes in mean densities were evaluated (Figure 2a, b).

Statistical Analysis

The density of the inner wood was expressed as the mean density +/- standard deviation. The differences between the means of the two groups were compared using the paired t-test. A p-value 0.05 was considered statistically significant.

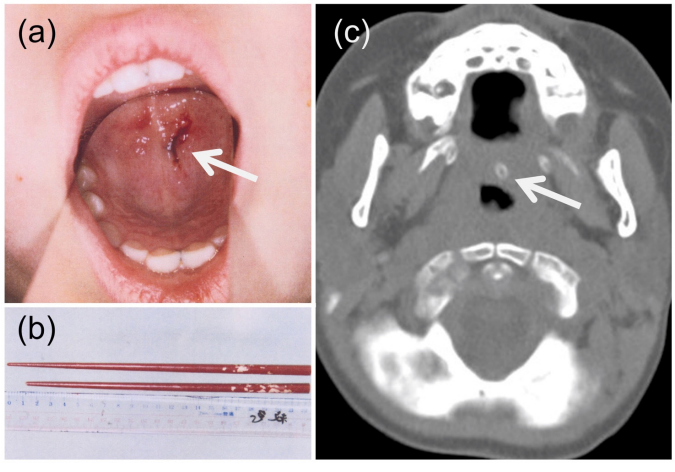

Figure 1. Three-year-old boy with transoral chopstick penetration injury **(a)** Photograph of the oral cavity. Laceration and small amount of bleeding on the soft palate (arrow). Chopstick is not visible. **(b)** A broken chopstick and an unbroken chopstick. The broken chopstick was approximately 1 cm shorter than the other unbroken chopstick. **(c)** A non-contrast-enhanced CT image of the soft palate shows a ring-shaped dense lesion (arrow), consistent with a broken chopstick
CT: Computed tomography

Results

The densities of all 10 chopsticks gradually increased after immersion in saline, while the density of the non-wooden acrylic chopstick (#10) remained unchanged (Figure 2c-e). Quantitative evaluation of the density of the inner wood material showed that the average density was -184.3 +/- 58.8 HU immediately after immersion and increased to 62.5 +/- 51.3 HU after 3 days ($p<0.005$) (Figure 2f). After 30 days, the density was 139.4 +/- 15.6 HU, which was significantly higher than the density after 3 days ($p<0.005$).

Discussion

Wooden chopsticks are made from a variety of woods and coating methods, and CT images show a variety of findings. In addition, there is a risk of missing the buried chopstick in

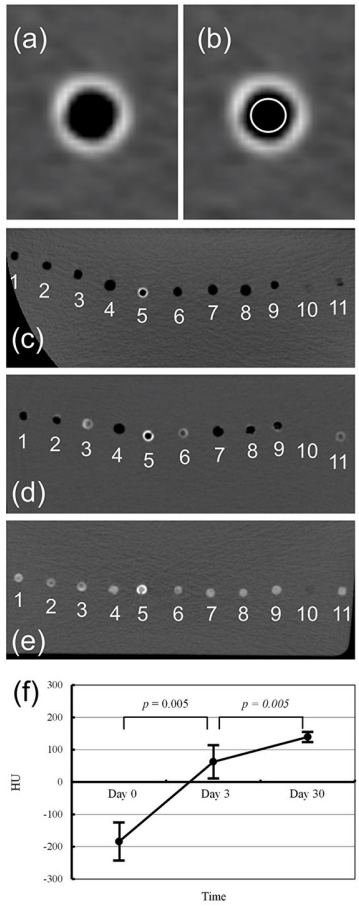

Figure 2. Phantom study of wooden (#1-9, #11) and non-wood (#10) chopsticks immersed in saline solution. **(a)** Axial CT of a commercial chopstick. **(b)** A circular region of interest was placed in the inner material, and its average density was measured. **(c)** Immediately after immersion in saline solution. **(d)** Three days after immersion in saline solution.
(e) Thirty days after immersion in saline solution. **(f)** Quantitative assessment of density changes in wooden chopsticks. The mean density of the 10 wooden chopsticks was -184.3 +/- 58.8 HU, 62.5 +/- 51.3 HU, and 139.4 +/- 15.6 HU immediately, 3 days, and 30 days after immersion, respectively
CT: Computed tomography

the body because its density changes over time and becomes similar to that of air and soft tissue.[1-4] This study presents a quantitative assessment of density changes in wooden chopsticks using CT for the first time. The results of our phantom study indicate that the density of wooden chopsticks increases from 184.3 to 139.4 HU and can be confused with air, soft tissue, hematoma, and calcification. In addition, it is important to characterize the time from injury to CT because the density of wooden chopsticks changes over time.

In this case, the chopsticks were not disposable and were used regularly, which may have caused the wood material inside the chopsticks to contain moisture, resulting in a high density of inner wood material. The good thing about this case was that the coating on the wooden chopstick was easily visible on CT as a ring-like hyperdense lesion. However, if the chopsticks are not coated, the density of the wood may be comparable to that of the surrounding normal tissue or air,[1-4] making it difficult to detect chopsticks buried within the body. This is the first study to quantitatively evaluate changes in the density of commercially available chopsticks. Since the study was conducted using commercially available wooden chopsticks, real-world assessment was performed. The limitation of this study is that the types of wood used in the experiment and the degree of dryness varied. The initial moisture content can affect the density of the wood, as the density at CT increases as the wood absorbs moisture.

Conclusion

The density of wooden chopsticks can vary greatly depending on when they are buried. Gathering detailed information about the exact date and time of injury and the material of the broken chopstick is helpful for accurate diagnosis and prompt treatment.

Footnote

Informed Consent: Informed consent was obtained from the parents for the use of the clinical data and images.

Financial Disclosure: The author declared that this study received no financial support.

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