



## Case study

## Morulae in neutrophils: A diagnostic clue for human granulocytic anaplasmosis

Sungim Choi<sup>a</sup>, Young-Uk Cho<sup>b</sup>, Sung-Han Kim<sup>a,\*</sup><sup>a</sup> Department of Infectious Diseases, Asan Medical Center, University of Ulsan College of Medicine, Seoul, South Korea<sup>b</sup> Department of Laboratory Medicine, Asan Medical Center, University of Ulsan College of Medicine, Seoul, South Korea

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## ABSTRACT

Although there was no specific finding in peripheral blood smears performed on the second day after doxycycline administration in clinically suspected human granulocytic anaplasmosis (HGA) patients, we re-examined the peripheral blood smears performed at the time of admission and found morulae in neutrophils. This case shows that the detection of morulae in a blood smear can be helpful in the diagnosis of HGA, especially in the acute phase of illness, prior to empirical antibiotic administration.

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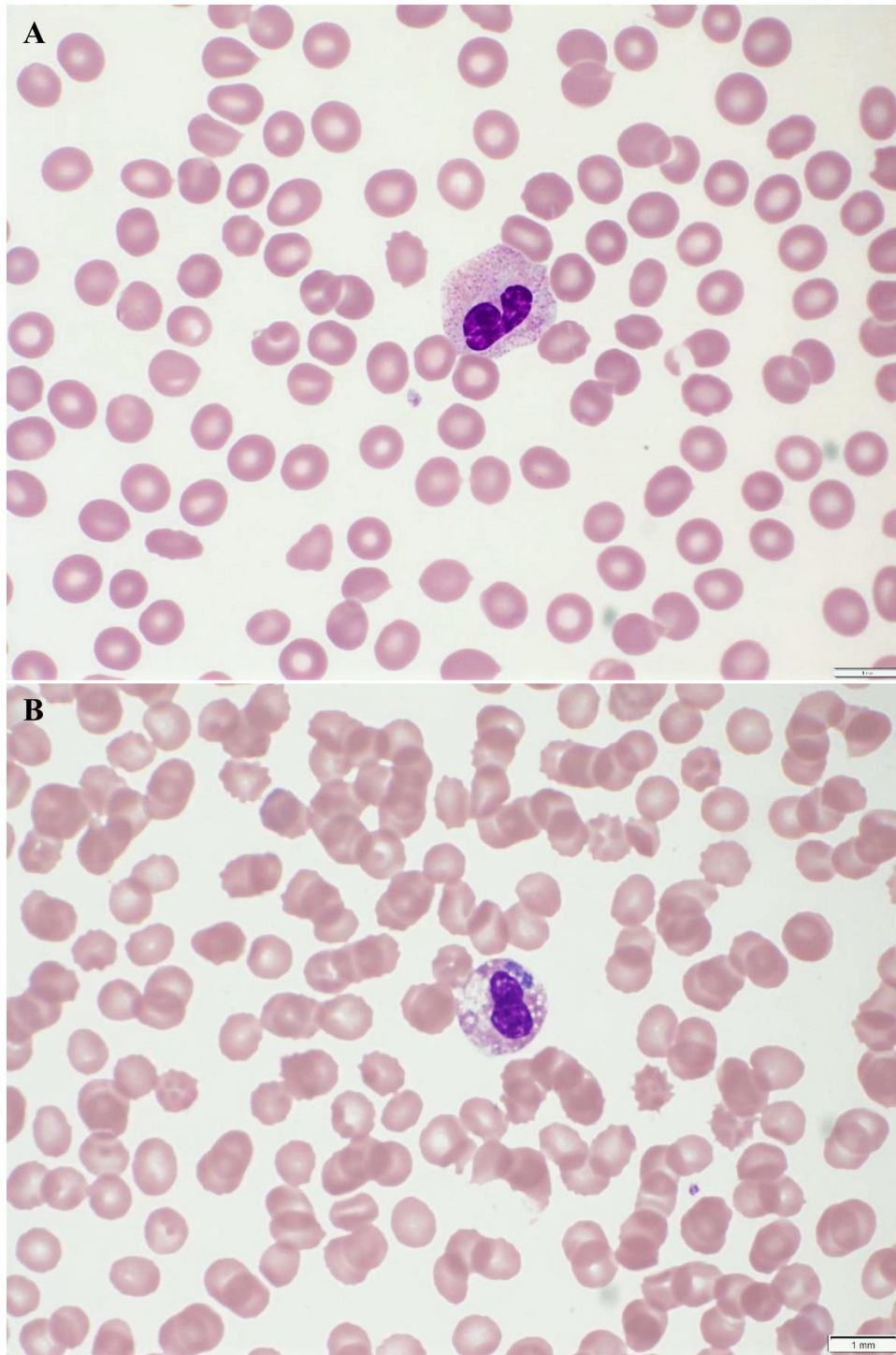
An 82-year-old woman living in a rural area of South Korea was admitted for fever, generalized weakness, and altered mental status for 5 days. Her family stated they had removed a tick from the patient's neck seven days before admission. Her white blood cell count was 2,500/ $\mu\text{L}$  with 87.6% segmented neutrophils, platelet count was 25,000/ $\text{mm}^3$ , C-reactive protein was 26.66 mg/dL and procalcitonin was 15.36 ng/mL. Aspartate transaminase, creatine kinase and myoglobin were elevated. Brain MRI and cerebrospinal fluid analysis showed no specific findings. She was empirically treated with doxycycline (100 mg twice a day) and her clinical signs gradually improved. On hospital day (HD) 2, *O. tsutsugamushi*, *R. typhi*, hantaviral and leptospiral antibodies revealed all negative results, and reverse transcription polymerase chain reaction (RT-PCR) for severe fever with thrombocytopenia syndrome (SFTS) virus from her blood exhibited negative result. Peripheral blood smear was performed considering human

granulocytic anaplasmosis (HGA) on HD 2, but there was no specific finding (Fig. 1A). Therefore, we re-examined the peripheral blood smears performed at the time of admission. We found morulae in neutrophils (Fig. 1B). Diagnosed as HGA, the patient was discharged with oral doxycycline with the resolution of symptoms. Eventually, Korea Center for Diseases Control and Prevention reported positive PCR result for HGA from her blood.

HGA is a tick-borne illness caused by *Anaplasma phagocytophilum* and it is important to distinguish from other tick-borne diseases. Detection of morulae in the peripheral blood smear can provide a rapid diagnostic clue for HGA. However, morulae are most likely to be found during the first week of illness and disappear within 24–72 h after starting doxycycline [1]. This case shows that the detection of morulae in a blood smear can be helpful in the diagnosis of HGA, especially in the acute phase of illness, prior to empirical antibacterial administration.

\* Corresponding author at: Department of Infectious Diseases, Asan Medical Center, University of Ulsan College of Medicine, 88, Olympic-ro-43-gil, Songpa-gu, Seoul, 05505, South Korea.

E-mail address: [shkimmd@amc.seoul.kr](mailto:shkimmd@amc.seoul.kr) (S.-H. Kim).



**Fig. 1.** Peripheral blood smears.

(A) Peripheral blood smears performed on the second day after doxycycline administration showing no specific finding.

(B) Peripheral blood smears performed at the time of admission showing morulae in neutrophils.

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### **Conflict of interests**

There are no potential conflicts of interest to declare.

### **Consent**

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of

the written consent is available for review by the Editor-in-Chief of this journal on request.

### **Author contributions**

- 1 Sungim Choi: Data collection, writing.
- 2 Young-Uk Cho: Investigation, revising.
- 3 Sung-Han Kim: Conceptualization, final approval to be submitted.

### **References**

- [1] [Shah JS, Horowitz R, Harris NS. Human babesiosis and ehrlichiosis-current status. Eur Infect Dis 2012;6:49–56.](#)