

Two vivax malaria cases detected in Korea

Seung-Yull Cho^{1)*}, Yoon Kong¹⁾, Sill Moo Park²⁾, Joon Seung Lee²⁾, Young Ae Lim³⁾,
Seok Lae Chae³⁾, Weon-Gyu Kho⁴⁾, Jong Soo Lee⁴⁾, Jae Chul Shim⁵⁾
and Hak-Kyoon Shin⁵⁾

Departments of Parasitology¹⁾, Internal Medicine²⁾ and Clinical Pathology³⁾, College of Medicine,
Chung-Ang University, Seoul 156-756; Division of Parasitology⁴⁾ and Division of Entomology⁵⁾,
National Institute of Health, Seoul 122-020, Korea

Abstract: On June and July 1994, two cases of vivax malaria were consecutively diagnosed at the Yongsan Hospital, Chung-Ang University in Seoul. The first patient was a soldier serving in western parts of the demilitarized zone (DMZ) while the second case was a resident of a village near DMZ. Neither patients had history of being abroad. Republic of Korea (ROK) has been free of malaria since the mid-1970s except for imported cases. The two vivax malaria cases, together with an additional patient detected in 1993, occurred in relatively small areas near DMZ. This necessitated an epidemiologic surveillance. When medical records and blood smears in the areas were examined, no other cases were found. Of 7,723 mosquitoes collected by a black light trap for two nights in June, 7,066 (91.5%) were *Anopheles sinensis*. In order to evaluate a significance of the recent malaria occurrence, a surveillance system should be operated in the areas.

Key words: Indigenous malaria, *Plasmodium vivax*, Korea

In Korea, control activities against the endemic malaria due to *Plasmodium vivax* had been done in the 1960s mainly by active and passive case detection combined with chemotherapy (National Malaria Eradication Service, Ministry of Health and Social Affairs, ROK, 1966; Paik *et al.*, 1988). Together with the control activities and improved socioeconomic state of people, the ecology has been changed since the 1970s because of extensive use of pesticides and herbicides in agriculture. It is now widely accepted in ROK that the indigenous malaria stopped its endemicity in the mid-1970s (Paik *et al.*, 1988). Several vivax malaria cases without history of being abroad were filed in a literature of the 1980s (Soh *et al.*, 1985).

However, those sporadic cases have been regarded as relapse of vivax malaria rather than primary infections because hypnozoites of Korean strain *P. vivax* has been notoriously known to having long dormancy. In this context, a vivax malaria case was recognized in 1993 at a military camp near western DMZ (Chai *et al.*, 1994). In addition to this case, we came across two patients of vivax malaria in two areas nearby DMZ, and record them here to discuss their epidemiologic significance.

The first case, SHK, a 23-year old ROK Army soldier, drafted on March 1993, has been serving at southern border of DMZ (Paikhakmyon, Yonchon-gun, Kyonggi-do) as a signal man in reconnaissance battallion of an infantry division. Abrupt attacks of fever and chills have been developed since May 22, 1994. He was treated at division dispensary and at army evacuation hospital for 2 weeks during

• Received Sep. 7 1994, accepted after revision Oct. 14 1994.

* Corresponding author

which intermittent fevers continued. He was transferred to the Yongsan Hospital on June 8, 1994. He was acutely ill looking and slightly anemic. He complained of fever, chills, abdominal pain at left upper quadrant, general weakness and weight loss (13 kg in 17 days). Laboratory findings were normal except lowered levels of hemoglobin (10 g/dl) and hematocrit (29%). Serologic tests for typhoid fever, Korean hemorrhagic fever, tsutsugamushi disease, and murine typhus were non-reactive. Abdominal sonography revealed normal findings except for an enlarged spleen of 14 cm long. In a blood smear made for leukocyte differential count, trophozoites and gametocytes of malaria parasite were found in pale and enlarged erythrocytes. Few Schueffner's dots were recognized. After diagnosed as *P. vivax* malaria, he was treated with quinine (which was immediately available in pharmacies in Seoul) in doses of 600 mg, three times a day for 4 days and was transferred to army hospital to be treated with primaquine (15 mg/kg body weight/day for 2 weeks). Since birth, he had been living in Seoul until enlisted in the army. He has never been abroad. He had no histories of blood transfusion and narcotic drug injections. He said he had been bitten by mosquito more than 50 times at each summer night when ambushing near DMZ.

For epidemiologic surveillance, a total of 25 blood smears of the platoon soldiers were examined in June 1994, of which no smears were positive for *P. vivax*. No fever cases were detected in nearby villages. By examining medical records at a local public health center dispensary, it was confirmed that there have been no fever patients in recent 2 months. Of 7,723 mosquitoes collected by a light trap installed at a cow shed for 2 days, 7,066 (91.5%) were identified as *Anopheles sinensis* which is the known vector of *P. vivax* in Korea. Other collected species were *Aedes vexans* (6.1%), *Culex pipiens pallens* (2.4%) and one specimen of *Culex tritaeniorhynchus*.

The second case, DWK, 59-year old female, was a house guardian for elderly farmers located in Majong-2-ri (village), Munsan eub, Paju-gun, Kyonggi-do. Geographically the village is no farther than 4 km from DMZ (Fig.

1) and located at about 15 km southwest from the point where the first case served. The patient was surgically treated for chronic otitis media on March 24, 1994 at the Yongsan Hospital, and was followed up for the post-operational cares until April 28 and then returned home. Since June 25, fever and chills have been developed. On July 1, she was brought by her neighbors back to the Yongsan Hospital. At the Emergency Room, the neighbors suggested that she seemed to be ill of malaria because the fever developed every other day, which they had experienced in the 1960s. Duty doctor made a thin blood smear in which a few ring forms, trophozoites and gametocytes of malaria parasites were recognized in pale and enlarged erythrocytes. *P. vivax* was diagnosed. Chloroquine diphosphate was administered in 900 mg in 3 divided doses on the first day and 300 mg on the next 3 days. Thereafter, primaquine was dosed. She denied any history of being outside the village except for the above mentioned trip to Seoul for treatment.

Epidemiological surveillance was also done. No fever cases had occurred in the past 9 months when medical records in dispensaries at an elementary school and at a local public health center near the village was examined. By asking two medical doctors practicing in nearby Munsan-eub and Kumchon-eub, it was confirmed that they had never come across malaria in the past 2 years.

Together with a case of vivax malaria detected in the area in 1993 (Chai *et al.*, 1994), the detection of two more patients during a month was not an insignificant event to the Korean public health workers. Definitely they were not induced malaria because they had no history of narcotic drug injections. Only the second case of this report had a history of blood transfusion during the surgery for chronic otitis media on the late March. But the interval of 3 months between the blood transfusion and the development of fever on the late June denies a possibility of an induced malaria. Furthermore, since the 1970s, there have been no malaria case records due to blood transfusion in Korea because of the disappearance of malaria endemicity. Both patients had no previous history of malaria.

Relapses after long dormancy seems not possible.

As suggested by Chai *et al.* (1994), a possibility of introduced malaria should be considered because all three patients occurred in a relatively small focus. Actually, recent immigration of work forces from malaria endemic countries into Korea provided a chance of reestablishment of endemic malaria in local areas. In this connection, *Anopheles sinensis* in Korea have been known to be an inefficient vector even for Korean strain of *P. vivax* (Ree *et al.*, 1967). Therefore, vectorial inefficiency of Korean strain of *A. sinensis*, mainly due to extreme zoophilism (over 90%), biting habits out-door (Paik *et al.*, 1988), should be negatively taken into account in considering a possibility of introduced malaria.

In the national surveillance of malaria undertaken in 1961-1965 by active and passive case detections (National Malaria Eradication Service, 1966), the present areas (Paju-gun and Yonchon-gun) were classified as relatively low endemic areas where a total of 171 cases was detected. In other areas of endemic foci of comparable size (Yoju-gun and Ichon-gun), the number of cases was 3,017 in central Kyonggi-do. Another thing to mention is that ecology in the areas near to DMZ is now well preserved when compared with other parts of Korea. It is mainly due to long prohibition of agriculture for 40 years due to strategic location of the areas. This ecological preservation provide relatively favorable conditions for possible malaria transmission, mainly due to high density of vector mosquitoes.

Because all the detected patients had no history of visiting endemic countries, they were not imported cases of conventional sense. However, the contraction of malaria is now known to be possible in non-endemic countries through import of infected mosquitos brought by airplanes from endemic foci. In addition, infected mosquitos seems to be transported to areas remote from an airport, hidden in airplane baggages (Castelli *et al.*, 1994). In this sense, vivax malaria in the present patients can be contracted by infected mosquitos which came across DMZ. Sporadic occurrence of cases, both geographically (Fig. 1) and



Fig. 1. A map showing the areas where the malaria patients were detected. (*): the camp and village where the patients describe in this report has lived. (O): the camp where the case reported by Chai *et al.* (1994) resided.

chronologically, suggests this possibility. Officially speaking, DMZ is 4 km wide between the north and south borders. But the width is much narrower in many parts. In this connection, an dispersion experiment using female *Culex tritaeniorhynchus* exhibited that the mosquitos flew 7.5 km in a night (Ree *et al.*, 1978) although average flight distance was 1.5 km. Therefore, infected mosquitoes can traverse DMZ. The hypothesis, that the present cases of malaria are contracted by imported mosquitoes, can make sense only when malaria transmission is presumed to be active in the other side of DMZ. Unfortunately, however, we do not have any information on the malaria situation in the North Korea. We need more information concerning malaria occurrence in the present areas to make any decent conclusion. On long-term basis, a surveillance system for detection of contingent cases seems necessary to evaluate the situation realistically.

REFERENCES

Castelli F, Cabona MG, Brunori A, Carosi G (1994) Imported mosquito: An uninvited guest. *Am J Trop Med Hyg* **50**: 548-549.

Chai IH, Lim GI, Yoon SN, Oh WI, Kim SJ, Chai JY (1994) Occurrence of tertian malaria in a male patient who has never been abroad. *Korean J Parasit*: **32**: 195-200.

National Malaria Eradication Service, Ministry of Health and Social Affairs, ROK (1966) Malaria pre-eradication programme in Korea, Progress report. 1961-1965 (with English resume) p44-

70. Seoul.

Paik YH, Ree HI, Shim JC (1988) Malaria in Korea. *Jpn J Exp Med* **58**: 55-60.

Ree HI, Hong HK, Lee JS, Wada Y, Lolivert P (1978) Dispersal experiment on *Culex tritaeniorhynchus* in Korea. *Korean J Zool* **21**: 59-66.

Ree HI, Hong HK, Paik YH (1967) Study on natural infection of *Plasmodium vivax* in *Anopheles sinensis* in Korea. *Korean J Parasit* **5**: 3-4 (in Korean with English abstract).

Soh CT, Lee KT, Im KI, et al. (1985) Current status of malaria in Korea. *Yonsei Rep Trop Med* **16**: 11-18.

=국문초록=

비무장지대 부근에서 발생한 양성 삼일열 말라리아 환자 2례

중앙대학교 의과대학 기생충학교실¹⁾, 내과학교실²⁾, 임상병리학교실³⁾ 및 국립보건연구원 기생충과⁴⁾, 매개곤충과⁵⁾

조승열¹⁾, 공 윤¹⁾, 박실무²⁾, 이준승²⁾, 임영애³⁾, 채석래³⁾, 고원규⁴⁾, 이종수⁴⁾, 심재철⁵⁾, 신학균⁵⁾

중앙대학교 용산병원에 입원한 환자 중 1994년 6월 및 7월에 양성 삼일열 환자 모두 1례씩 2례를 기생충학적으로 진단하였다. 제1례는 경기도 연천군에 위치한 육군 보병사단의 사병이었으며 비무장지대 남방한계선에서 근무 중 발병하였고 제2례는 경기도 파주군 문산읍 마정리 주민이었다. 이들은 외국여행이나 마약사용 경험이 없었다. 우리 나라에는 1960년대 정부의 말라리아 근절사업과 농약사용 등으로 인하여 1970년대 중반 이후 환자가 발생하지 않은 것으로 평가되고 있었다. 1993년에 휴전선 인근에서 발생하였던 말라리아 증례와 함께 이번 발생은 역학적으로 중요하다고 판단하여 경기도 파주군 및 연천군에서 환자 발생이 있었는지를 역학적으로 조사하였다. 즉, 부대원 및 주민에 대한 문진, 보건지소 및 인근 국민학교 의무실의 의무기록 조사, 그리고 소속 소대원의 혈액도말을 검사하였으나 추가 발생은 확인할 수 없었다. 경기도 연천군에서 1994년 6월 하순 유문등으로 모기를 수집한 결과 1일 3,862마리였고 그중 91.5%가 중국얼룩날개모기이었다. 지금까지는 지역적으로나 시간적으로는 산발적으로, 기생충 종별로는 양성 삼일열 환자만 발생하고 있다. 이러한 발생 양상은 재도입 말라리아(introduced malaria)가 소규모로 발생한 양상이라고 하기 보다는 오히려 비무장지대를 날아 넘어 온 감염모기로 발생한 것이라고 추정함이 역학적으로나 논리적으로 타당하다고 생각하였다. 그러나 북한의 말라리아 발생 여부에 대한 정보가 없고 또 아직 환자발생 숫자가 적어 확실한 결론에 도달하기 어렵다고 판단하였다. 문제의 실체를 파악하고 대책을 마련하기 위하여 경기도 북부지역의 말라리아 환자 발생에 대한 역학적 조사팀을 구성, 운영하여야 할 필요가 있다고 생각한다.

(기생충학잡지 32(4): 281-284, 1994년 12월)