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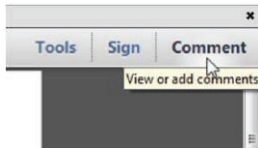
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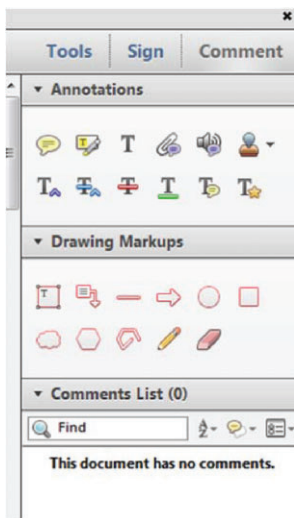
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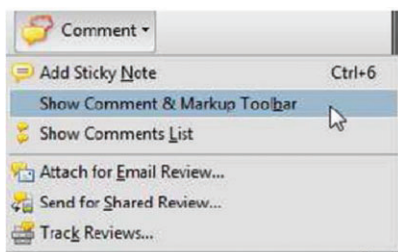


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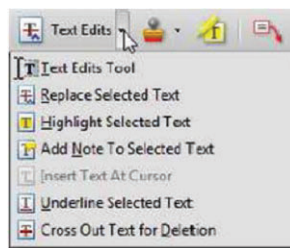
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Malaria diagnosis in an emergency department before and after the COVID-19 pandemic: a retrospective study

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Background: The COVID-19 pandemic impacted access to health facilities.

Methods: We assessed the number of blood smears sampled in the emergency department (ED) among all blood smears performed for malaria in our hospital before and after 2020.

Results: We showed a decrease in the number of blood smears performed after the onset of the COVID-19 pandemic, but only in 2020. The seasonal increase of cases during summer was preserved. All blood smears positive for malaria in 2020 were sampled in the ED.

Conclusions: The ED played a key role in the diagnosis of malaria with the onset of the COVID-19 pandemic.

Keywords: blood smear, COVID-19, emergency department, France, malaria

Introduction

Imported malaria accounts for almost the total number of malaria cases in European countries, especially during the summer.¹ Each year nearly 1500 (mainly *Plasmodium falciparum* then *Plasmodium vivax*) and 4000 (mainly *Plasmodium falciparum* then *Plasmodium ovale*) malaria cases occur in the UK and France, respectively, especially among patients of African origin.^{2,3} Thick and thin blood smears examination (TTBS) remains the cornerstone of the diagnosis of malaria, but it can require the referral of the patient to hospital for testing, even if criteria for outpatient management exist.^{2,3} In the present manuscript, we assess the number of TTBS sampled in the emergency department (ED) among all the TTBS performed in our university hospital before and after the onset of the COVID-19 pandemic, which had an impact on access to health facilities.⁴

Methods

All TTBS performed in Reims University Hospital from 1 January 2011 to 31 December 2021 and referenced in the Parasitology Laboratory management system (Labo Serveur, Inlog) were screened. Each year, only the first TTBS positive for malaria was included in a case of serial samples and the corresponding clinical data were extracted from medical records. The patients were not

required to provide individual consent because of the retrospective and non-interventional nature of this study, in accordance with French legislation. None had previously objected to the further use of their medical data. Data confidentiality was preserved throughout this internal study (Reims University Hospital GDPR register number MR00402022022), in accordance with the principles of the Declaration of Helsinki. The numbers of outpatient visits and of hospital admissions in and via the ED were supplied by the Medical Information department. Quantitative variables were compared using Student's t test and qualitative variables expressed as percentages were compared using Pearson's χ^2 test. $p < 0.05$ was considered as significant. Statistical analyses were performed using Stat view 5.0 software (SAS institute).

Results

Three hundred and twelve of the 2324 TTBS performed during the study period in Reims University Hospital were included. Those TTBS positive for malaria had been performed in 306 different patients. Six patients had been included twice because of episodes of malaria occurring in two different years of the study period. There was a slight male predominance (178 patients) and the mean age was 33.2 ± 17.5 y. Two hundred and sixty-two patients (83.9%) were of African ancestry.

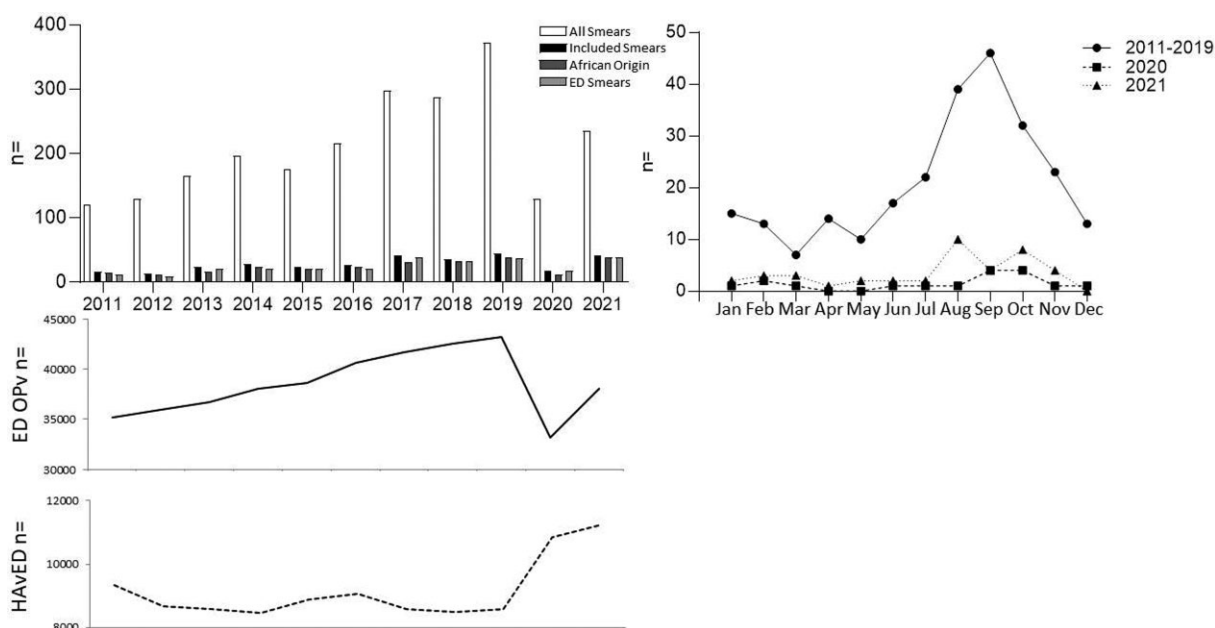


Figure 1. Left: upper section, the number (n) of thick and thin blood smears examinations (i) performed in Reims University Hospital (all smears), (ii) positive for malaria (included smears), (iii) positive for malaria and sampled in patients of African ancestry (African origin) and (iv) positive for malaria and sampled in the emergency department (ED smears) across 2011–2021; lower section, the number of emergency department outpatient visits (ED OPv) (plain line) and the number of hospital admissions via the emergency department (HAvED) (dashed line) across 2011–2021. Right: the cumulative number (n) of included thick and thin blood smears examinations positive for malaria across the months before (2011–2019) and after the onset of the COVID-19 pandemic (2020 and 2021).

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The number of positive TTBS across years or months is shown in Figure 1. Two hundred and sixty-six (85.2%) and 142 (45.5%) TTBS were sampled in the ED and outside of working hours (i.e. between 18:00 and 08:00 h), respectively. There was no significant association between gender ($p=0.16$), African origin ($p=0.84$) and having a TTBS sampled in the ED. Interestingly, 126 TTBS of the 142 (88.7%) sampled outside of working hours, and 140 TTBS of the 170 (82.3%) sampled within working hours, came from the ED ($p=0.03$). The mean age of patients with TTBS sampled in the ED was lower than that of patients with TTBS sampled elsewhere: 32.2 ± 17.7 vs 38.9 ± 16.3 y ($p=0.02$).

In 36 cases (11.5%), a previous TTBS performed in a biological laboratory outside of the hospital was positive for malaria. Among those, patients were then referred to the ED in 25 cases (69.4%).

In three cases (0.9%), an earlier TTBS was negative for malaria in the previous 7 d. Among those, in the supplementary material we describe a case illustrating the difficulty in establishing the diagnosis out of the hospital.

Discussion

Most (85.2%) of the included TTBS positive for malaria were sampled in the ED and a previously positive TTBS was only evidenced in a minority of cases (11.5%). This suggested that ED physicians are the main prescribers of TTBS in our centre and that they should maintain a high degree of suspicion of malaria, in case of fever after travel return, regardless of whether the patients have taken prophylaxis (see the Supplementary Material).²

The data from Figure 1 show a decrease in the number of TTBS performed after the onset of the COVID-19 pandemic, but only in 2020, probably because of the lockdown and a reduction in the number of flights. The seasonal trend with cases increasing during and immediately after the summer holiday months¹ was preserved to a lesser extent after the onset of the COVID-19 pandemic. Interestingly, 17 of the 17 (100.0%) TTBS positive for malaria in 2020 had been sampled in the ED, while the number of outpatient visits decreased (Figure 1).

Conclusion

Taken together, this study suggests that the ED played a key role in the diagnosis and treatment of malaria before as well as after the onset of the COVID-19 pandemic. Even if we presumed that patients of African ancestry could self-refer to the ED, because only a minority of migrants have registered with a General Practitioner within 5 y after arriving in France,⁵ we did not find a significant association between having TTBS performed in the ED and African origin. This suggested that all patients (especially children, see mean age above) could benefit from the ED, to make the diagnosis of malaria as well as gain access to antimalarial drugs outside of working hours.

Supplementary data

Supplementary data are available at [Transactions](#) online.

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Q27 **Authors' contributions:** SD and MG contributed equally to this work. AH
130 and YNG contributed equally to this work. AB and YNG conceived the
study; MG, AB and AH implemented the study. Data were analysed by SD,
MG and YNG. SD, AH and YNG drafted the manuscript, which was critically
reviewed by all co-authors.

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the preparation of this manuscript.

135 **Funding:** None.

Competing interests: None declared.

Q28 **Ethical approval:** Not required.

Q29 **Data availability:** Data available on request.

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