

Original Article

Asian Pacific Journal of Tropical Medicine

apjtm.org

doi: 10.4103/apjtm.apjtm_425_25

Arboviral infections in solid organ transplant recipients in Southern Thailand: A case series

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ABSTRACT

Objective: To describe the clinical features and outcomes of arboviral infections in solid organ transplant recipients (SOTRs).

Methods: This study included SOTRs identified from a passive surveillance cohort of 1 466 patients with acute undifferentiated febrile illness between 2012 and 2019. Diagnosis of arboviral infection was confirmed using RT-PCR and/or serological testing. Clinical, laboratory, and outcome data were extracted and analyzed descriptively.

Results: Eleven SOTRs (10 kidney, 1 heart transplant recipient) were diagnosed with arboviral infections: 8 with dengue (DENV), 2 with chikungunya virus (CHIKV), and 1 with Zika virus (ZIKV) infection. The median time from transplantation to symptom onset was 35.0 days (IQR 28.5-111.0). DENV infection was associated with severe disease, including dengue shock syndrome (50%, 4/8) and dengue hemorrhagic fever (25%, 2/8). Six patients (75%, 6/8) required ICU admission. Common laboratory abnormalities in dengue patients included leukopenia (100%, 8/8), thrombocytopenia (100%, 8/8), elevated transaminases (87.5%, 7/8), and acute kidney injury (50%, 4/8). CHIKV and ZIKV cases presented as mild, self-limiting febrile illnesses without complications. All patients recovered without long-term morbidity.

Conclusions: DENV infection in SOTRs is associated with significant morbidity, particularly early post-transplant, and requires heightened clinical vigilance. In contrast, CHIKV and ZIKV infections tend to follow a benign course. Enhanced vector control, early diagnostic testing, supportive management, and consideration of dengue vaccination in appropriate candidates are essential to mitigate the impact of arboviral infections in transplant recipients in endemic areas.

KEYWORDS: Arboviruses; Dengue; Zika; Chikungunya; Solid organ transplantation

1. Introduction

Arboviruses, or arthropod-borne viruses, are a diverse group of RNA viruses transmitted primarily through arthropod vectors such as mosquitoes and ticks. Prominent arboviruses include dengue virus (DENV), chikungunya virus (CHIKV), and Zika virus (ZIKV), all of which are endemic in tropical and subtropical regions. These viruses represent a significant public health burden in Southern Thailand, a region characterized by a high prevalence of mosquito-borne arboviral diseases due to its climate and geography[1-4].

Solid organ transplantation (SOT) is a life-saving procedure

Summary

Question: What are the clinical characteristics and outcomes of arboviral infections in solid organ transplant recipients (SOTRs) in Southern Thailand?

Findings: In this passive surveillance cohort (2012-2019), 11 SOTRs were diagnosed with laboratory-confirmed arboviral infections: 8 dengue, 2 chikungunya, and 1 Zika. Dengue occurred early post-transplant, frequently presenting with severe disease (dengue shock syndrome 50%, hemorrhagic fever 25%), and 75% required ICU admission. In contrast, chikungunya and Zika infections followed mild, self-limited courses without complications.

Meaning: Dengue infection in SOTRs is associated with significant morbidity early after transplantation, underscoring the need for heightened vigilance, supportive management, and preventive strategies in endemic regions.

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How to cite this article: Chittrakarn S, Chusri S. Arboviral infections in solid organ transplant recipients in Southern Thailand: A case series. Asian Pac J Trop Med 2025; 18(9): 415-420.

Article history: Received 25 July 2025 Revision 24 September 2025
Accepted 25 September 2025 Available online 29 September 2025

for patients with end-stage organ failure, but it necessitates lifelong immunosuppression to prevent graft rejection. This immunosuppressive state predisposes transplant recipients to an increased risk of opportunistic and endemic infections, including arbovirus infections[5]. Despite the clinical relevance of these infections in this vulnerable population, data on arbovirus infections in SOT recipients remain limited, particularly in Southeast Asia, where arboviruses are highly prevalent.

The clinical presentation and course of arboviral infections in SOT recipients can be atypical or severe due to the altered immune response associated with immunosuppressive therapy. Complications such as severe dengue with plasma leakage, thrombocytopenia, and secondary bacterial infections may pose significant risks in this group[6]. Early recognition and management of arbovirus infections are therefore critical to improving outcomes in SOT recipients. This study aims to define the clinical characteristics of arbovirus infections in solid organ transplantation in Southern Thailand.

2. Methods

2.1. Study design and participants

Data were extracted from a passive surveillance study conducted between 2012 and 2019 in Southern Thailand on acute undifferentiated febrile illness. Data extraction and statistical analysis were completed on April 30, 2025.

In 2012, the Armed Forces Research Institute of Medical Sciences (AFRIMS), Department of Virology, began an ongoing collaboration with Prince of Songkhla University (PSU) in Songkhla, Thailand, to identify causes of undifferentiated febrile illness in the region. PSU is the largest medical school in southern Thailand and operates a major public hospital, Songklanagarind Hospital, located in the largest city in Songkhla, Hat Yai. This hospital is a 1 000 bed tertiary care hospital, which receives referrals from multiple onsite and offsite outpatient clinics.

Individuals of all ages presenting acutely to participating clinical centers with undifferentiated fever or history of fever within 7 days, not attributable to any non-arboviral cause of fever such as pneumonia or urinary tract infection, were eligible for enrollment. Demographic data and clinical characteristics were included. Written informed consent/assent was obtained per the primary protocol, with parental/guardian consent and participant assent for children per local requirements. Patients meeting criteria for testing had 5 mL of blood collected at their acute (enrollment) visit and were requested to return no more than 21 days later for a repeat (convalescent) sample. Those not meeting these criteria or only having a single acute specimen were not included in the analysis. Acute specimens underwent RT-PCR testing for DENV, CHIKV, and ZIKV, followed by serological testing for these same arboviral infections as the volume of residual specimen allowed.

Confirmation of acute arboviral infection was performed using both molecular and serological methods. Qualitative detection of DENV, CHIKV, and ZIKV RNA from acute-phase serum was conducted using a multiplex reverse transcription polymerase chain reaction (RT-PCR) assay (Certest Biotec S.L., San Mateo de Gállego, Zaragoza, Spain). Serologic confirmation was based on either seroconversion or a ≥4-fold rise in IgG titers between the acute and convalescent phases, or the detection of IgM antibodies in the acute-phase serum by ELISA (EUROIMMUN Medizinische Labordiagnostika AG, Germany).

Patients included in this analysis were enrolled between June 2012 and December 2019 at Songklanagarind Hospital and 7 community clinics that utilize PSU Hospital as a referral center.

2.2. Statistical analysis

Continuous variables were presented in median and interquartile ranges (IQRs). Categorical variables were presented in frequencies and percentages. Statistical analyses were performed using R Language and Environment, version 2.14.1 (The R Project for Statistical Computing).

2.3. Ethical approval

Approval for this study was granted by the Human Re-search Ethics Committee (REC. 68-043-14-1; date of approval: 30 January 2025) Prince of Songkla university, and the research was conducted following the principles of the Declaration of Helsinki.

3. Results

Among 1466 febrile individuals enrolled, 11 solid organ transplant recipients (SOTRs) were identified with laboratory-confirmed arboviral infections: 8 cases of dengue virus (DENV), 2 cases of chikungunya virus (CHIKV), and 1 case of Zika virus (ZIKV). The median age was 48 years [interquartile range (IQR) 42-51], and 10 of 11 patients (90.9%) were male. Ten patients were kidney transplant recipients, and one was a heart transplant recipient. The median time from transplantation to symptom onset was 35.0 days (IQR 28.5-111.0) (Table 1).

Diagnosis of acute arboviral infections was confirmed *via* RT-PCR and/or serological testing. Most cases (9/11) showed evidence of secondary infection, as indicated by positive IgG in acute serum and significant rises in IgG titers in convalescent samples. All dengue

Table 1. Demographics and transplant characteristics of SOT recipients with arboviral infections.

No.	Sex	Age (year)	Initial BW (kg)	Organ transplanted	Current immunosuppressive agents	Onset of symptoms post-transplant (days)	Date of symptoms (days)
1	M	45	62	Kidney	MMF, CNI, prednisolone	25	4
2	M	52	71	Kidney	Prednisolone	231	5
3	M	41	58	Kidney	CNI, prednisolone	132	6
4	M	55	49	Kidney	CNI, prednisolone	29	5
5	M	52	54	Heart	MMF, CNI, prednisolone	30	7
6	M	48	52	Kidney	MMF, prednisolone	27	4
7	M	42	65	Kidney	MMF, prednisolone	35	5
8	M	39	60	Kidney	CNI, prednisolone	38	6
9	M	50	63	Kidney	NA	90	5
10	M	49	47	Kidney	NA	369	2
11	F	42	50	Kidney	CNI, prednisolone	28	6

SOT: solid organ transplantation; BW: body weight; M: male; F: female; MMF: mycophenolate mofetil; CNI: calcineurin inhibitor; NA: not available.

Table 2. Diagnosis of acute arboviral infection in SOT recipients.

No.	Acute serum IgM	Acute serum IgG	Acute serum IgG titer	Convalescence serum IgG titer	RT-PCR	Primary or secondary infection
1	Positive (Day 4)	Positive (Day 4)	1:40 (Day 4)	1:640 (Day 11)	DENV2	Secondary
2	Positive (Day 5)	Positive (Day 5)	1: 80 (Day 5)	1:1 280 (Day 12)	DENV3	Secondary
3	Positive (Day 6)	Positive (Day 6)	1: 40 (Day 6)	1:640 (Day 14)	DENV4	Secondary
4	Negative (Day 5)	Negative (Day 5)	< 1: 20 (Day 5)	1:640 (Day 10)	DENV2	Primary
5	Positive (Day 7)	Positive (Day 7)	1: 80 (Day 7)	1:2 560 (Day 9)	DENV2	Secondary
6	Negative (Day 4)	Positive (Day 4)	1: 20 (Day 4)	1:1 280 (Day 13)	DENV1	Secondary
7	Positive (Day 5)	Positive (Day 5)	1: 80 (Day 5)	> 1:2 560 (Day 9)	DENV2	Secondary
8	Positive (Day 6)	Positive (Day 6)	1: 40 (Day 6)	1:2 560 (Day 12)	DENV3	Secondary
9	Negative (Day 5)	Positive (Day 5)	1: 20 (Day 5)	1:2 560 (Day 14)	CHIKV	Secondary
10	Negative (Day 2)	Negative (Day 2)	< 1: 20 (Day 2)	1:1 280 (Day 10)	CHIKV	Primary
11	Positive (Day 6)	Positive (Day 6)	1: 80 (Day 6)	> 1:2 560 (Day 12)	ZIKV	Secondary

SOT: solid organ transplantation; DENV: dengue virus; CHIKV: chikungunya virus; ZIKV: Zika virus.

cases were confirmed by RT-PCR, with four different DENV serotypes identified; DENV2 was the most common, followed by DENV3. Both CHIKV cases and the ZIKV case were confirmed by serology and RT-PCR (Table 2).

Clinical presentations varied by pathogen (Table 3). DENV infections frequently manifested with fever, myalgia, headache, and gastrointestinal symptoms. Notably, 4 out of 8 dengue cases (50%) developed dengue shock syndrome (DSS), 2 (25%) developed dengue hemorrhagic fever (DHF), and 2 (25%) had classic dengue fever (DF). CHIKV and ZIKV infections are presented as acute febrile illness (AFI) with generally mild systemic symptoms, including arthralgia and rash, and no features of severe disease.

Laboratory findings are summarized in Table 4. All DENV-infected patients experienced leukopenia [median initial WBC 1 978 cells/uL (IQR 1 012-2 082)] and thrombocytopenia [median initial platelets 92 600/uL (IQR 61 500-99 000)]. Elevated transaminase levels and acute kidney injury (defined by more than 1.5 times baseline or ≥0.3 mg/dL increase in serum creatinine) were common, particularly among patients with DSS or DHF. However, no patients initiated hemodiaylsis. In contrast, patients with CHIKV or ZIKV had relatively preserved white blood cell and platelet counts and no evidence of organ dysfunction.

Clinical outcomes are presented in Table 5. Six of the eight dengue patients (75%) required ICU admission, with a median length of

Table 3. Clinical presentations of arbovirus infection in SOT recipients.

No.	Diagnosis	Body temp (℃)	Headache/ Retroorbital pain	Myalgia	Arthralgia	Rash	Abdominal pain	Nausea	Diarrhea	URI symptom	Clinical syndrome
1	DENV	38.8	yes	yes	no	yes	no	yes	no	no	DSS
2	DENV	37.8	yes	no	yes	yes	yes	no	yes	no	DSS
3	DENV	39.4	no	yes	no	no	no	yes	no	yes	DF
4	DENV	39.2	yes	no	no	yes	no	yes	yes	no	DSS
5	DENV	38.8	yes	yes	yes	yes	no	no	no	no	DSS
6	DENV	37.9	no	yes	no	no	no	no	no	no	DF
7	DENV	38.7	yes	yes	no	yes	no	yes	no	yes	DHF
8	DENV	40.5	yes	yes	yes	yes	yes	no	no	no	DHF
9	CHIKV	40.2	yes	yes	yes	no	yes	no	no	no	AFI
10	CHIKV	39.4	yes	no	yes	no	yes	yes	yes	no	AFI
11	ZIKV	38.5	no	yes	no	yes	yes	no	no	no	AFI

SOT: solid organ transplantation; DENV: dengue virus; CHIKV: chikungunya virus; ZIKV: Zika virus; DF: Dengue fever; DHF: dengue hemorrhagic fever; DSS: dengue shock syndrome; AFI: acute febrile illness; URI: upper respiratory tract infection.

Table 4. Clinical presentations of arbovirus infection in SOT recipients.

No.	Diagnosis	Initial WBC (/μL)	Nadir WBC (/μL)	Initial Hb (g/dL) / Hct (%)	Initial platelet (/μL)	Nadir platelet (/μL)	Initial SGOT (IU/mL)	Initial SGPT (IU/mL)	AKI*
1	DENV	2314	1245	15/45	98000	78000 (Day 6)	458	400	Yes
2	DENV	1952	695	16/50	96000	89000 (Day 7)	235	302	Yes
3	DENV	3025	1569	14/43	165400	98500 (Day 9)	256	214	No
4	DENV	953	953	16/51	56400	56400 (Day 5)	158	195	No
5	DENV	1024	1024	15/49	89200	89200 (Day 7)	184	172	Yes
6	DENV	2004	2004	13/39	102000	96000 (Day 7)	35	30	No
7	DENV	2005	2005	13/41	63200	63200 (Day 5)	136	148	No
8	DENV	978	978	14/46	52800	52800 (Day 6)	230	244	Yes
9	CHIKV	7895	2300	13/40	237000	87000 (Day 8)	28	30	No
10	CHIKV	5879	1996	14/46	184500	78900 (Day 5)	28	29	No
11	ZIKV	5627	1457	13/40	249000	98600 (Day 7)	30	32	No

SOT: solid organ transplantation; DENV: dengue virus; CHIKV: chikungunya virus; ZIKV: Zika virus; WBC: white blood cell count; AKI: acute kidney injury; SGOT: serum glutamic-oxaloacetic transaminase; SGPT: serum glutamic pyruvic transaminase; *AKI defined by more than 1.5 times baseline or ≥0.3 mg/dL increase in serum creatinine.

Table 5. Clinical outcomes and laboratory findings at follow-up of arbovirus infection in SOT recipients.

No.	Diagnosis	Management	Length of hospital stay (days)	Outcome	WBC (/μL)	Hb (g/dL) / Hct (%)	Platelet (/μL)	SGOT (IU/mL)	SGPT (IU/mL)	Recovery of AKI**
1	DENV	ICU	21	Discharge	8956	13/40	213000	32	41	Yes
2	DENV	ICU	20	Discharge	9561	14/43	365980	45	49	Yes
3	DENV	IPD-General	7	Discharge	7524	14/40	269800	49	53	-
4	DENV	ICU	31	Discharge	6359	14/43	198750	30	38	-
5	DENV	ICU	25	Discharge	3697	13/39	215400	48	40	Yes
6	DENV	IPD-General	7	Discharge	6987	13/39	298000	22	27	-
7	DENV	ICU	16	Discharge	9654	13/41	236900	19	23	-
8	DENV	ICU	19	Discharge	8990	14/40	369800	32	41	Yes
9	CHIKV	IPD-General	5	Discharge	12345	13/40	256900	25	21	-
10	CHIKV	ICU	7	Discharge	9865	13/39	456000	27	21	-
11	ZIKV	IPD-General	6	Discharge	6987	13/39	369800	25	30	-

SOT: solid organ transplantation; DENV: dengue virus; CHIKV: chikungunya virus; ZIKV: Zika virus; IPD: inpatient department; WBC: white blood cell count; SCr: serum creatinine; AKI: acute kidney injury. **Recovery of AKI defined as serum creatinine reaching a value < 1.5 times the baseline and absolute value reduction > 0.3 mg/dL. "–": not applicable (patient did not develop AKI, therefore recovery of AKI could not be assessed).

stay of 21.0 days (IQR 19.3-24.0). Despite the severity of illness, all patients recovered and were discharged. CHIKV and ZIKV infections had shorter hospitalizations (5-7 days) and did not require ICU-level care, except for one CHIKV infection admitted for observation. Follow-up laboratory assessments revealed significant improvement across all parameters.

4. Discussion

4.1. Dengue virus (DENV) in SOT recipients

This study highlights the clinical spectrum and outcomes of arboviral infections among solid organ transplant recipients (SOTRs) in an endemic region of Southern Thailand. Dengue virus emerged as the predominant pathogen, accounting for 8 out of 11 cases, and was associated with severe clinical manifestations, including dengue shock syndrome (DSS) and dengue hemorrhagic fever (DHF).

Compared to the general population, DENV infection in SOTRs in our cohort appeared more severe, with a high proportion of patients requiring ICU admission and experiencing complications such as acute kidney injury, elevated liver enzymes, and significant cytopenias. In the general population in Thailand, the proportion of DSS is reported to be only 1%-3%, compared to 50% in our cohort[7]. Previous studies in SOTRs have reported similar findings, with more severe disease and higher rates of hospitalization and ICU admission. The rate of severe dengue in prior studies ranged from 12% to 15%, which is notably lower than observed in our series[8,9]. This difference may be explained by the fact that most of our cases occurred early post-transplant, a period characterized by intense immunosuppression. In contrast, previous studies involved patients infected more than one year after transplantation. Additionally, most patients in our study had secondary dengue, which may have contributed to more severe disease due to antibody-dependent enhancement[10]. Notably, DENV2 was the most commonly identified serotype in our cohort, followed by DENV3 both serotypes historically associated with more severe outcomes[11].

All patients in our study had favorable outcomes without significant morbidity, likely due to prompt diagnosis, appropriate supportive management, and tailored immunosuppressive adjustments. All

patients were hospitalized. While most recovered without long-term complications, the risk of temporary allograft dysfunction must still be acknowledged. Previous studies have shown that dengue infection in kidney transplant recipients is associated with a higher incidence of renal function deterioration compared to the general population and patients with chronic kidney disease[12]. However, this impairment is usually mild and tends to return to baseline following resolution of the infection. The proposed mechanisms are varied and may include pre-renal azotemia due to capillary leakage and hypotension, rhabdomyolysis, or direct tubular injury from viral antigens[13].

Overall, these findings reinforce the importance of clinical vigilance, timely supportive care, and the inclusion of dengue in the differential diagnosis of febrile illness in transplant recipients, particularly in dengue-endemic regions. The predominance of early post-transplant infections in our cohort highlights a critical window of vulnerability, during which intense immunosuppression and impaired immune responses may predispose patients to more severe manifestations. Preventive strategies and heightened awareness during this period are essential to reduce arboviral-related morbidity in solid organ transplant recipients.

4.2. Chikungunya virus (CHIKV) in SOT recipients

In contrast to dengue, CHIKV infection was identified in two kidney transplant recipients in our cohort, both of whom presented with acute febrile illness without complications. These cases were characterized by fever, myalgia, and arthralgia, with no significant hematologic abnormalities or organ dysfunction. One patient was admitted to the ICU for observation, but both recovered fully without progression to severe disease.

Our findings are consistent with data from several case reports and small series, which showed that CHIKV infection in transplant recipients tended to follow a classic clinical course similar to that in the general population. Common features include fever, arthralgia, and mild leukopenia or thrombocytopenia. None of the reported solid organ transplant recipients developed severe complications or experienced graft dysfunction[14–16].

Only one report has described CHIKV infection in a liver transplant recipient who developed headache and drowsiness. MRI findings were suggestive of viral encephalitis. Although the patient's serum IgM and IgG were positive for CHIKV, RT-PCR was negative, and cerebrospinal fluid analysis was not performed, leaving the diagnosis of CHIKV-associated neuroinvasion unconfirmed[17].

Overall, our observations support the broader literature, indicating that CHIKV infection in SOTRs is typically non-severe and self-limited. Nonetheless, close clinical monitoring remains important, particularly in patients early after transplantation or those with additional comorbidities.

4.3. Zika Virus (ZIKV) in SOT recipients

Only one case of ZIKV infection was identified in our cohort. This patient presented with non-specific febrile illness accompanied by rash and arthralgia, without conjunctivitis, and recovered fully without complications. Laboratory parameters remained stable, and there was no evidence of allograft dysfunction at follow-up.

ZIKV infection in transplant recipients is rarely reported. A case series published from Brazil in 2022 described four SOT recipients with ZIKV infection, all of whom developed secondary complications such as bacterial infections, worsening renal function, or gastrointestinal bleeding[18]. One patient required re-transplantation due to hepatic artery thrombosis and biliary stenosis 91 days after ZIKV detection. In contrast, our patient experienced a mild clinical course without complications. This difference may be attributed to factors such as younger age, fewer comorbidities, and absence of antimetabolite use in our patient.

These contrasting outcomes underscore the heterogeneity of ZIKV presentation in transplant recipients and highlight the importance of close monitoring, particularly in patients with risk factors for complications.

4.4. Clinical and diagnostic considerations

Diagnosing arboviral infections in SOTRs can be challenging due to atypical presentations and the potential overlap with symptoms of graft rejection or drug toxicity. This is further complicated in regions where multiple arboviruses co-circulate, as overlapping clinical features such as fever, rash, myalgia and arthralgia can make differentiation between viruses difficult without laboratory confirmation.

In our cohort, despite concerns regarding false-negative serologic tests in immunocompromised patients due to impaired antibody responses[19], all patients were diagnosed through serologic testing, either with positive IgM or a four-fold rise in IgG titers. However, 2 of 11 cases had negative IgM, and the four-fold rise in IgG did not aid in acute diagnosis. This limitation underscores the value of nucleic acid testing, such as RT-PCR, particularly during the acute phase of illness when viral RNA may still be detectable. Paired serologic testing remains useful in cases where RT-PCR is unavailable or inconclusive.

4.5. Strengths and limitations

Strengths of our study include the use of molecular confirmation, the inclusion of a wide timeframe, and the comprehensive clinical and laboratory characterization of each case. Limitations include the small sample size, the reliance on passive surveillance which may miss milder or asymptomatic cases, and the lack of long-term follow-up to assess post-discharge outcomes.

In conclusion, in endemic regions, febrile illnesses in SOTRs should prompt early consideration of arboviral infections. Preventive measures, including patient education, mosquito bite prevention strategies, and community-level vector control, remain essential. There is also an urgent need for prospective studies evaluating the clinical impact of arboviruses in immunocompromised hosts, and for research into safe and effective vaccination strategies for this vulnerable population.

Conflicts of interest statement

The authors declare no conflicts of interest.

Funding

This research received no external funding.

Data availability statement

The data that support the findings of this study can be accessed by contacting the corresponding author, available on request to interested researchers.

Authors' contributions

Both authors contributed equally to all aspects of this study, from conceptualization to manuscript editing.

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Edited by Zhang Q, Lei Y, Pan Y