

CLINICAL CASE SERIES

Post Dengue Fever Epidural Abscess With or Without Spondylodiscitis: A Case Series of Eight Patients in a Single Season in a Single Center

Does the Dengue Have a Predilection for the Neural Tissue?

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Study Design. A retrospective case series.

Objective. The aim of this study was to report the immunosuppression and secondary bacterial infection after dengue viral infection and the predilection of these infections in the spine. This can trigger further research in to this fact. The possibility of change in the serotype of dengue virus, which are neurotropic, may be looked into.

Summary of Background Data. This is the largest case series of epidural abscess with or without spondylodiscitis within 6 weeks following dengue virus infection.

Methods. We performed a retrospective review of all the eight cases treated for epidural abscess with or without spondylodiscitis within 6 weeks following dengue virus infection in our center during the period of 3 months from June 2017 to August 2017.

Results. Of the eight cases, three of them were infected with Methicillin Resistant Saphylococcus Aureus and all of them grew the bug in the blood culture. Three of them had Methicillin Sensitive Staphylococcus Aureus (MSSA), one with MSSA septicemia, and one had associated Elizabeth Kingia meningoseptica infection and one patient had positive Acid Fast Bacilli stained in smears. Two patients were infected with pseudomonas. Some patients had multiple site abscess and epidural abscess without spondylodiscitis. Five of them had neurological deficit, which recovered with abscess drainage and antibiotic treatment. The Erythrocyte Sedimentation rate, C-Reactive Protein, and serum ferritin were elevated in these patients.

Conclusion. This is a large case series of epidural abscess with or without spondylodiscitis within 6 weeks following dengue virus infection. The predilection of dengue virus for the neural tissue should be further investigated. Post dengue immunosuppression also needs further study.

Key words: Acid Fast Bacilli, dengue virus, Elizabeth kingia meningoseptica, epidural abscess, immunosuppression, Methicillin Resistant Saphylococcus Aureus, Methicillin Sensitive Staphylococcus Aureus, pseudomonas, retrospective study, spondylodiscitis.

Level of Evidence: 4

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Dengue fever is caused by dengue virus of flaviviridae.² It is a pandemic disease¹ spread by *Aedes aegypti* mosquitoes.² One of the dengue-related study points that there occurs about 390 million dengue infection per year out of which 96 million manifest clinically.³ Dengue fever has a wide range of manifestations both typical and atypical.⁴ Some authors state that these unusual presentations of dengue may be due to concurrent infections caused by fungi,⁵ bacteria,⁶ or protozoa.⁷ Recently, clinical reports have been emerging on the possible neurological complications associated with dengue.⁸ The unusual presentations of dengue fever include rhabdomyolysis, acute renal failure,¹⁰ fulminant liver failure,⁹ myocarditis,¹¹ transverse myelitis⁸ encephalopathy, Guillan Barrie Syndrome.^{12,13} Associated bacterial infection may be considered if the fever goes beyond 7 days¹⁴ along with elevated Erythrocyte Sedimentation rate and C-Reactive Protein. Here, we are reporting spondylodiscitis with or without epidural abscess in patients with a recent history (within 6 weeks) of dengue fever. From June 2017 to August 2017, the total number of dengue cases reported or diagnosed in our hospital is 1407. Eight of them developed dengue hemorrhagic fever (DHF). Nine cases presented in our department with recurrence of fever and diagnosed as spondylodiscitis with or without epidural abscess. These patients presented with variable severity of fever and back pain.

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IMMUNOSUPPRESSION DUE TO DENGUE VIRUS

The neuropathogenesis in dengue infection is poorly understood.¹⁵ It is caused directly by the virus or post-infectious immune-mediated injury.¹⁵ A study suggests that the postinfectious onset of neurological symptoms and flaccid paraplegia can be a direct invasion of neural tissue by the virus, whereas late-onset neurological symptoms and spastic paraplegia are attributed to immunologically mediated neurological injury.¹³ In a study, dengue virus is shown to reduce cell-mediated immunity in mice.¹⁶ The major factors are reduced lymphocyte proliferation and inhibition of leukocyte migration. In an *in vitro* study, splenic T lymphocyte from dengue virus infected mice produces cytotoxic factor (CF), which kills variety of cells mainly macrophages, helper T cells, T effector lymphocyte, but not bacterial epithelial or fibroblastic tissue culture cells. Survived macrophages will produce another cytotoxic substance (CF2), which amplifies cytotoxic effect. Induction of an antigen-specific suppression pathway in mice when infected with dengue virus is also demonstrated *in vivo*.¹⁷ When mice are infected, virus induce activation of Ts1 in mouse spleen to produce a soluble factor that is transmitted through macrophage to recruit second subpopulation, Ts2. Ts2 produce a prostaglandin-like substance SF2, which recruit third subpopulation of Ts. This mediates antigen-specific suppression of IgM antibody-forming cells.¹⁶ Human leukocyte when treated *in vitro* with CF and CF2 shows diminished phagocytic activity. Same effect is also observed when monkeys are inoculated with CF.¹⁶

Thrombocytopenia and leucopenia are reported in dengue. Platelets count decrease from 3rd day up to 7th day of illness and will recover to normal by 8th or 9th day.¹⁸

The actual mechanisms underlying dengue virus induced bone marrow suppression during the acute phase remain unclear.

In early phase of disease, bone marrow shows hypocellularity and arrest of megakaryocytic maturation.¹⁸ Factors responsible for this are as follows¹⁹:

- (1) Direct lesion of progenitor cells by dengue virus;
- (2) Infected stromal cells;
- (3) Changes in bone marrow regulation;
- (4) Increased platelet consumption during coagulopathy²⁰;
- (5) Activation of coagulation system²⁰;
- (6) Increased peripheral sequestration²¹;
- (7) Development of antiplatelet antibodies²²;
- (8) Neutropenia and leucopenia in dengue can be due to virus induced destruction or inhibition of myeloid progenitor cells.²³
- (9) Histopathological studies of bone marrow from patients with severe dengue virus infection suggests that marrow suppression characterized by generalized hypoplasia by 4th day and returns to normal by 7 to 10 days.²⁴

No recorded data are available as of now on the incidence of epidural abscess in patients who have dengue fever.

CASE REPORT

Case 1

A 63-year-old gentleman, a known case of diabetes mellitus, was diagnosed to have dengue infection with a positive NS1 antigen test and was symptomatically treated elsewhere (No blood or blood product transfusion in any of these patients). Six weeks later, he was admitted to our hospital with high-grade fever, swelling over the left sternoclavicular joint, swelling right knee, and low backache, radiating to both lower limbs. There was an abscess of 2 × 1 cm over the left sternoclavicular joint and effusion in the right knee joint. He was further evaluated with further blood investigations (Table 1). Blood culture, knee aspirate, and pus from the sternoclavicular joint yielded Methicillin Resistant *Staphylococcus Aureus* (MRSA) sensitive to Meropenem and Teicoplanin. Magnetic resonance imaging (MRI) of the LS spine (Figure 1a1 and 1a2, <http://links.lww.com/BRS/B368>) showed epidural abscess at L4-5 extending up to S3. Abscess was seen in the paraspinal muscle from L4 to S2. He underwent hemilaminectomy at L4-5 and L5-S1 on the right side; epidural and paraspinal abscess was (Figure 1b, <http://links.lww.com/BRS/B368>) drained. MRSA was isolated in culture. In this case, there was no spondylodiscitis, and only epidural and paraspinal abscess were present. He was treated with Meropenem 1g intra venous (IV) three times daily for 2 weeks and injection Teicoplanin 600 mg IV for 6 weeks. At the time of discharge, he was put on cap rifampicin also after discussing with the clinical microbiologist. He was reviewed after 2 weeks of first admission. The blood culture showed MRSA again. So, the dose of Teicoplanin was increased to 800 mg IV. The blood reports are given in Table 1. At 6 weeks, repeat MRI lumbosacral spine showed no collection. The patient was asymptomatic and back to normal life at 6 weeks.

Case 2

A 62-year-old lady was diagnosed with dengue fever (NS1 antigen positive) and was treated elsewhere symptomatically. Six weeks later, she had gradual onset neck pain and numbness of right upper limb. She was afebrile. There was tenderness over the cervicothoracic junction. She had grip weakness on the right side (grade 3, MRC grading) and paresthesia over C7 and C8 dermatomes. She was evaluated further with hematological investigations (Table 1) and MRI. Blood culture showed no growth. MRI cervical spine showed C7-T1 discitis with epidural and paravertebral abscess extending from C7 to T1 (Figure 2A, <http://links.lww.com/BRS/B368>). She underwent abscess drainage, C7-T1 discectomy, and interbody fusion with iliac crest bone graft without instrumentation, through an anterior approach. Culture yielded Methicillin Sensitive *Staphylococcus Aureus* (MSSA). Acid Fast Bacilli (AFB) staining for the pus was positive. Biopsy specimen showed

TABLE 1. Clinical features

	Onset of Symptoms (Post Dengue)	Clinical Features				Diagnosis	Outcome
		Fever	BA	Deficits	Multiple Abscess		
Case 1	6 weeks	Yes	Yes	No	Yes	Epidural abscess L4-S3	Good
Case 2	6 weeks	NO	Yes	Yes	No	Spondylodiscitis C7-T1 epidural abscess C7-T1	Good
Case 3	1 week	Yes	Yes	No	No	Spondylodiscitis L3-L4 with epidural involvement	Good
Case 4	4 weeks	No	Yes	Yes	No	Spondylodiscitis C5-C6,C6- C7 with epidural involvement	Good
Case 5	2 weeks	Yes	Yes	Yes	Yes	Spondylodiscitis L2-L3 with epidural involvement	Good
Case 6	2 weeks	Yes	Yes	No	Yes	Spondylodiscitis L5-S1 with epidural involvement	Good
Case 7	1 week	Yes	Yes	Yes	No	Spondylodiscitis L4-L5	Good
Case 8	12 weeks	Yes	Yes	Yes	No	Spondylodiscitis L3-L4 with epidural involvement	Good

fibrocartilagenous tissue with focal infiltration of neutrophils and lymphocytes (Figure 2b, <http://links.lww.com/BRS/B368>). AFB culture was sent, which was reported negative at 6 weeks of intubation. She was treated with injection clindamycin 600mg twice daily according to sensitivity reports. She was put on anti-tuberculous medicines as well (four-drug regime – INH, rifampicin, ethambutol, and pyrazinamide). At the time of discharge, she improved neurologically. Her blood parameters also improved. Clindamycin injection was given for 6 weeks and anti-tuberculosis medicine is being continued for 1 year. At 6 weeks, she has completely recovered. Follow-up MRI showed no evidence of abscess.

Case 3

A 75-year-old man was diagnosed to have dengue fever (positive NS1 antigen) and was treated symptomatically elsewhere. After 1 week of normal period, he developed low backache and low-grade fever. He was evaluated hematologically (Table 1) and radiologically. Blood culture yielded no growth. MRI LS spine showed spondylodiscitis at L3-4 level with prevertebral paravertebral and epidural abscess extending from L3 to L4 level (Figure 3A1, Figure 3A2, <http://links.lww.com/BRS/B368>). He underwent left hemilaminectomy, abscess drainage, and discectomy at L3-4 level. The specimen grew pseudomonas species in culture. Histopathological examination showed fibrocartilagenous tissue with dense infiltration of neutrophils and lymphocytes (Figure 3B, <http://links.lww.com/BRS/B368>). He was treated with intravenous piperacillin-tazobactam combination 4.5 g three times daily for 6 weeks. Levofloxacin tablet was also added for 3 weeks in consultation with the microbiologist. His blood parameters improved at the time of discharge. At 6 weeks of follow-up, he was completely alright radiologically and clinically.

Case 4

A 71-year-old male was diagnosed to have dengue fever (positive NS1 antigen test) and was treated symptomatically elsewhere. Four weeks later, he developed acute onset neck pain and tingling sensation over both upper limbs. He had tenderness over his lower neck. He had weakness of hand grip bilaterally (grade 3). He had sensory blunting over C5, C6, C7 dermatomes of both upper limbs. He was evaluated hematologically (Table 1) and radiologically. MRI showed C5-6 discitis with epidural abscess causing compression of the spinal cord at C5-6 and C6-7 levels. Prevertebral and paravertebral collection extended from C3 to T1 (Figure 4a1 & 4a2, <http://links.lww.com/BRS/B368>). Blood culture grew MRSA. He was treated surgically with abscess drainage, discectomy at C5-6, and fusion with iliac crest graft. Culture grew MRSA. Pathologically, sheets of neutrophils were mixed with macrophages and lymphocytes (Figure 1). He was treated with piperacillin-tazobactam intravenously according to culture reports. The patient was neurologically normal before surgery, but 24 hours after surgery, patient developed weakness of both upper and lower limbs acutely (quadriplegia Frankel grade B). MRI cervical spine was repeated. It showed altered signal changes in the spinal cord from C3-D2 level along with epidural collection from C4-D1 level (Figure 4C1&4C2, <http://links.lww.com/BRS/B368>). Diffusion-weighted MRI showed cord ischemia probably due to anterior spinal artery thrombosis probably from septic emboli. It may be due to demyelination secondary to dengue viral infection. Neuromedicine consultation was sought. Anti-dengue immunoglobulin was given. The patient was taken back to theater again next day. C6-7 discectomy, drainage of abscess, and anterior interbody fusion with iliac crest graft was done without instrumentation. Microbiological studies showed MRSA sensitive to Teicoplanin. Histopathologically, there was evidence of

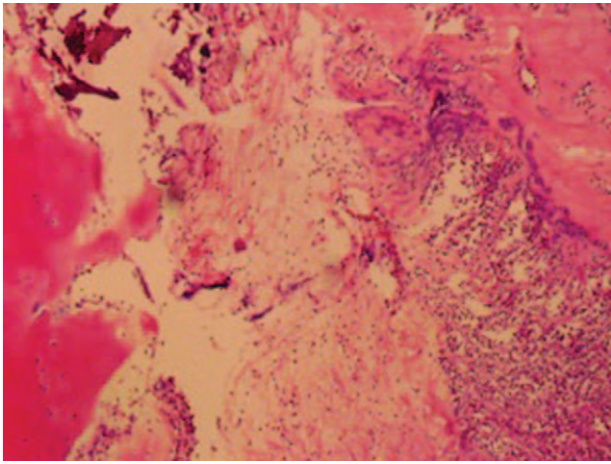


Figure 1. Biopsy C5-C6 disc showing sheets of neutrophils admixed with few macrophages and lymphocytes. Necrotic bone and osteoclastic giant cells were seen.

acute suppurative inflammation and degenerative changes (Figure 2). He was treated with Teicoplanin 600 mg IV once daily along with cap rifampicin 450 mg once daily. Physiotherapy was continued along with this. He was in the hospital for 1 month. His neurological status gradually improved. Injection Tekoplanin was continued for 6 weeks and cap rifampicin was continued for 4 weeks. At 3 months, he has recovered neurologically so that he can walk independently, but not completely. His blood parameters became normal.

Case 5

A 65-year-old male was diagnosed with dengue fever (positive and NS1 antigen test). He was treated symptomatically elsewhere. Two weeks later, he had acute onset tachypnea and desaturation. He was diagnosed to have secondary lung infection and pleural effusion (right). He was intubated and shifted to intensive care unit (ICU). Blood cultures yielded

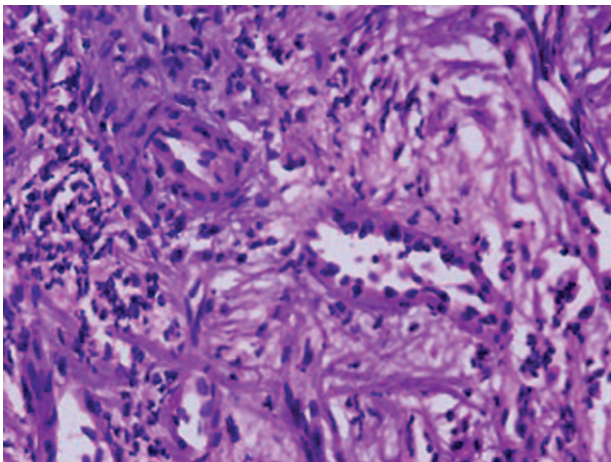


Figure 2. Biopsy C6-C7 disc showing cartilaginous tissue with hyalinization and focal granulation tissue formation. Areas show sheets of neutrophils admixed with few lymphocytes s/o acute suppurative inflammation and degenerative changes.

MRSA. His blood parameters are summarized in Table 1. He was diagnosed to have MRSA septicemia. He was treated with injection Meropenem 1 g IV three times daily and injection Tekoplanin 600 mg IV in consultation with the microbiologist. He developed acute kidney injury compensated metabolic acidosis and was hemodynamically unstable with uremic encephalopathy. He was started on hemodialysis. After starting Tekoplanin, he improved but had poor neurological recovery. MRI of the spine showed spondylodiscitis at L2-3 with prevertebral, paravertebral, and epidural and bilateral psoas abscess. Peripherally enhancing epidural lesion was noted from D12 to L2 level (Figure 5a1 and 5a2, <http://links.lww.com/BRS/B368>). He was treated by hemilaminectomy at L2-3, epidural abscess drainage, and discectomy at L2-3. Culture of the specimen yielded MRSA. Histopathologically, there was hyalinization with infiltration of neutrophils suggestive of acute spondylodiscitis (Figure 3). Repeat blood cultures also grew MRSA. With antibiotics, the patient gradually improved. His GCS became normal. Repeated blood cultures were negative for MRSA. He had cellulitis of right hand and forearm and Fournier gangrene, which was debrided by the general surgery colleagues. He was given linezolid 600 mg IV twice daily. He was in the ICU for 26 days. Thereafter, he was given physiotherapy. Antibiotics were continued. At the time of discharge, he was able to walk with support and blood cultures were negative. Injection Teicoplanin 600 mg IV once daily (OD) and cap rifampicin 600 mg OD was continued for 8 weeks. At 8 weeks, he was clinically better, but had occasional spikes of fever, so antibiotics were continued for 2 more weeks (total 10 weeks). On further follow-up, he was comfortable and was walking normally (Figure 4).

Case 6

A 49-year-old lady was diagnosed with dengue fever (positive and NS1 antigen test). She was treated symptomatically

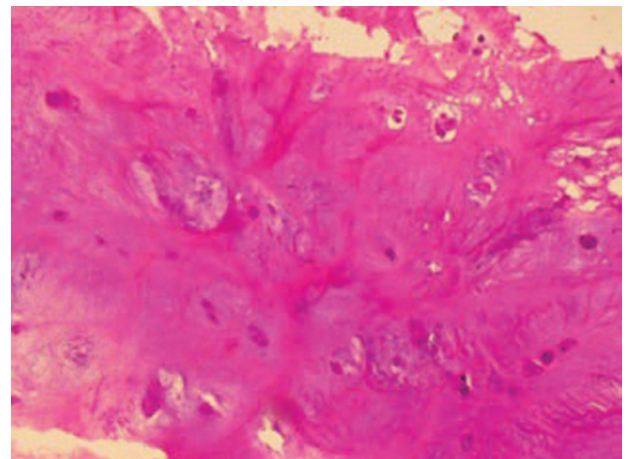


Figure 3. Biopsy L2-L3 disc showing fibrocartilagenous tissue with myxoid changes and hyalinization with infiltration of neutrophils and was suggestive of L2-L3 spondylodiscitis.

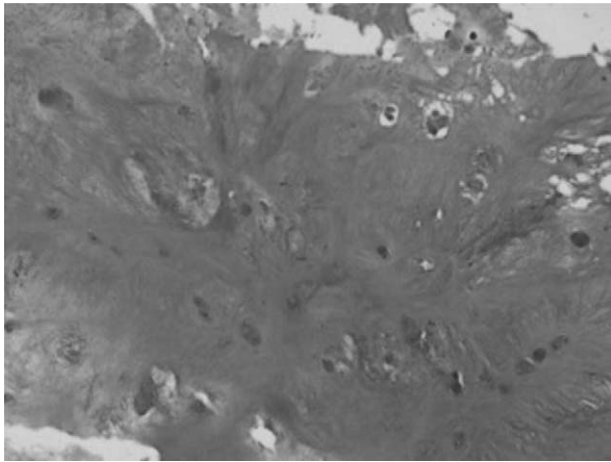


Figure 4. (A) MRI Cervical spine showing altered signal intensity in C5-C6 vertebral body with involvement of intervening discs. Associated with pre and para vertebral collection extending from C3-D1. Epidural collection also noted with compression on cord. (B) Histopathology from C5-C6 disc specimen showing sheets of neutrophils admixed with few macrophages and lymphocytes. Necrotic bone and osteoclastic giant cells also seen suggestive of spondylodiscitis. (C) Post operative (within 24-36 hours) MRI Cervical spine showing altered signal changes C3 TO D2 level with epidural collection extending from C4-D1 level with cord compression. (D) Biopsy from unhealthy granulation tissue from operative site showing cartilaginous tissue with hyalinization. Areas show sheets of neutrophils admixed with few lymphocytes s/o acute suppurative inflammation.

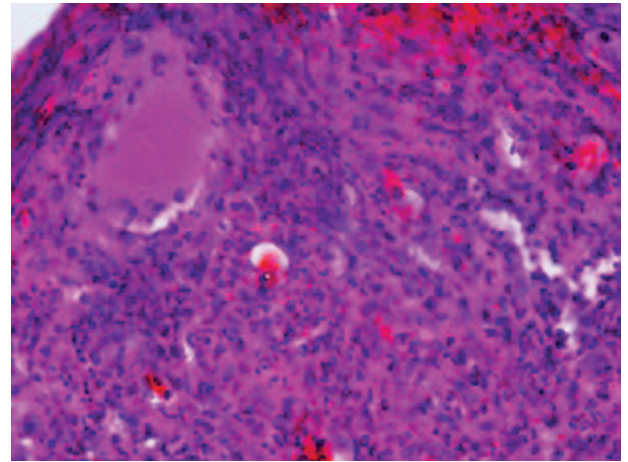


Figure 5. Biopsy L5 S1 disc and unhealthy epidural tissue showing bony tissue and cartilage with adjacent soft tissue exhibiting neutrophilic infiltrate consistent with suppurative inflammation.

elsewhere. Two weeks later, she had acute low backache with radiation to the lower limbs and fever.

She was evaluated hematologically (Table 1) and radiologically. MRI showed spondylodiscitis at L5-S1 with

epidural and paravertebral component ((Figure 6a1, and 6a2, <http://links.lww.com/BRS/B368>). She was treated surgically by left flavotomy at L5-S1 drainage of abscess. Pus culture yielded MSSA. Blood culture was negative. Histopathology showed acute suppurative inflammation (Figure 5). She was treated with piperacillin-tazobactam intravenously according to culture reports. Two days post-operatively, she had fever and breathing difficulty. Computed tomography (CT) scan of thorax showed empyema, which was aspirated under CT guidance. Culture of the specimen yielded MSSA. Blood culture also showed MSSA. She was then treated with cefoperazone-sulbactam combination, linezolid, and Rifampicin according to culture reports and in consultation with microbiologist. At 6 weeks,

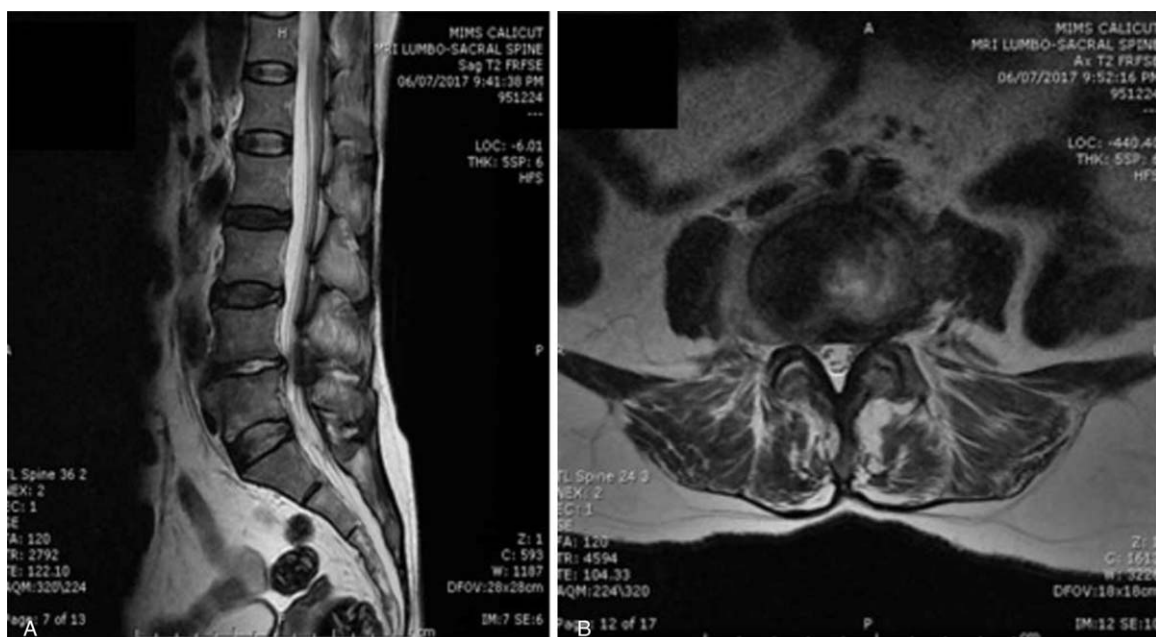


Figure 6. MRI LS spine with contrast showing degenerative changes and diffuse disc bulge at L4-L5 level with lateral recess and neural foraminal narrowing. Reduced L4-L5 disc space with edematous change-likely infective pathology.

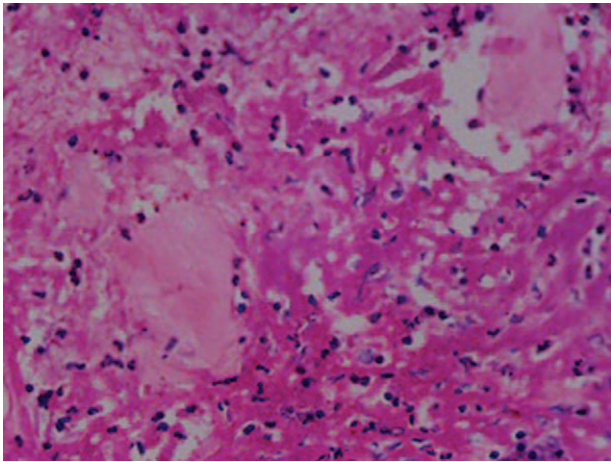


Figure 7. Biopsy L4-L5 disc showing fibrocartilagenous tissue with moderate infiltration of neutrophils, lymphocytes, and plasma cells with focal areas of hyalinization and hemorrhage. Findings were suggestive of acute discitis.

she recovered completely clinically, radiologically, and hematologically.

Case 7

A 54-year-old lady was diagnosed with dengue fever (positive and NS1 antigen test). She was treated symptomatically elsewhere. One week later, she had acute low backache with radiation to the lower limbs and fever.

She had Extensor Hallucis Longus weakness on the left side. MRI showed L4-5 discitis (Figure 6). Blood culture was negative. She was treated surgically by flavotomy L4-5 discectomy. Culture of the specimen yielded *Pseudomonas* species. Histopathology showed acute discitis (Figure 7). Injection cefoperazone-sulbactam and ciprofloxacin were given according to culture reports for 4 weeks. At 4 weeks, she was completely asymptomatic. She was given oral ciprofloxacin and trimethoprim Sulphamethoxazole combination for another 3 weeks.

Case 8

A 51-year-old male was diagnosed to have dengue fever (positive NS1 antigen test) and was treated symptomatically elsewhere. One month later, he presented with low backache and low-grade fever. He was evaluated radiologically and hematologically. MRI showed spondylodiscitis L3-L4 with prevertebral, paravertebral, and epidural soft tissue component (Figure 8). His knee extension was grade 4 (right) and his ankle dorsiflexion and toe extension were grade 4 (right). He underwent L3 hemilaminotomy drainage of abscess and L3-L4 discectomy. Culture yielded *Elizabeth Kingia meningoseptica* and *Staphylococcus aureus*. AFB stain was negative. He was treated according to culture sensitivity reports with Cefoperazone-sulbactam and ciprofloxacin. Histopathology showed acute discitis (Figure 9). He improved clinically and became normal at 6 weeks of therapy.

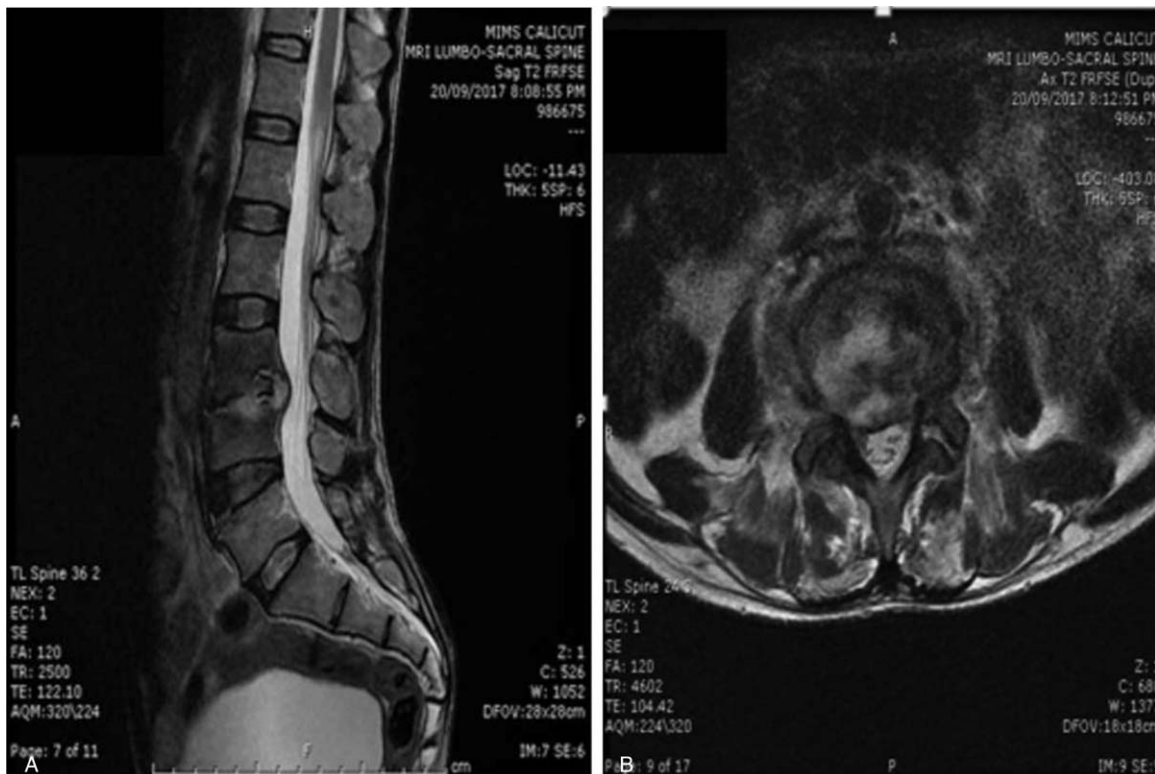


Figure 8. MRI LS spine showing altered signal intensity involving L3-L4 vertebral bodies with hyperintense disc showing contrast enhancement with prevertebral, paravertebral, and epidural soft tissue involvement.

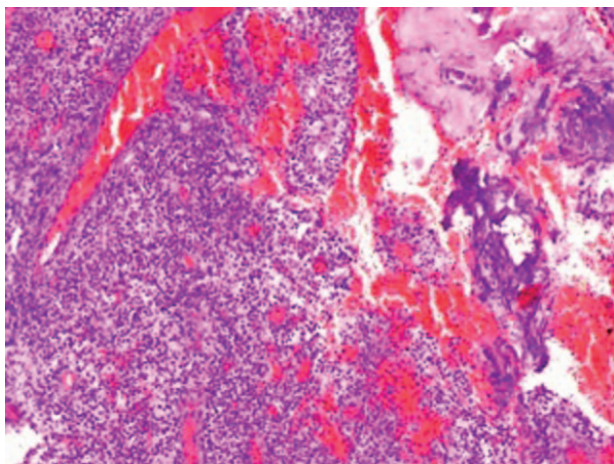


Figure 9. Biopsy from the specimen L3-L4 disc showing fibrocartilaginous tissue with dense infiltration of neutrophils, lymphocytes, and plasma cells s/o spondylodiscitis.

DISCUSSION

Recent upsurge of dengue fever is a major health concern. Complications and death associated with dengue fever are also increasing. Here, we report an unusual incidence of epidural abscess with or without spondylodiscitis in post dengue patients within 6 weeks of the primary illness. During the period of 3 months from June 2017 to August 2017, we had eight patients who developed epidural abscess with or without spondylodiscitis, septicemia, and other foci of infection.

Out of this, seven patients were treated elsewhere for dengue fever symptomatically. One patient presented to our hospital with dengue fever. They presented with variable symptoms such as stiff back, low grade fever, neurological deficits, and septicemia.

All patients were evaluated hematologically, microbiologically, and radiologically (Table 2). All patients underwent MRI to confirm epidural abscess and spondylodiscitis.

Out of eight patients, only one patient presented with septic shock and multiple abscesses. Out of three patients who had other site involvement, one patient had empyema with pleural effusion and one had abscess in the left sternoclavicular joint and septic arthritis of left knee. Preoperative neurological deficit was seen in five patients out of whom two patients had positive blood culture and one had septic shock. Out of four positive blood cultures, three were MRSA and one was MSSA.

Most of the patients underwent hemilaminectomy or flavotomy, decompression, and abscess drainage. Cervical spine was addressed anteriorly with discectomy, abscess drainage, and iliac crest grafting. The samples were sent for microbiological and histopathological studies.

Culture and sensitivity of pus yielded MRSA in three patients. *Pseudomonas* was observed in two patients, MSSA in one patient, MSSA with AFB in one patient, and MSSA and *Elizabeth kingia meningoseptica* in one patient. Biopsy showed suppurative discitis and infected tissues in all patients.

TABLE 2. Lab values

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	At Admission						At Discharge					At Follow-up				
	HB	TC	ESR	CRP	Serum Ferritin	Blood Culture	HB	TC	ESR	CRP	Blood Culture	HB	TC	ESR	CRP	Blood Culture
Case 1	10.2	35,500	112	141	382.3	MRSA	9.1	12,000	104		—	11.5	7800	25	5	MRSA
Case 2	10.8	11,500	116	73	741.12	—	10.1	10,500	105	21	—	—	—	37	17	—
Case 3	11.4	10,000	113	92	502.29	—	10	7000	111	14	—	—	—	—	—	—
Case 4	10.3	15,400	120	227	465.51	MRSA	11.6	10,500	110	30	—	—	—	—	—	—
Case 5	10	15,000	—	—	1551.37	MRSA	9.1	5900	33	21	—	—	—	—	—	—
Case 6	9.3	9600	117	102	610.97	—	9.9	6800	87	28	—	11.3	6200	51		—
Case 7	12.9	16,400	109	151	—	—	11	1000	1009	41	—	—	—	99	9	—
Case 8	11.9	7500	45	11	376.89	—	11.6	10,200	—	—	—	11.8.	7100	16	11	—

CRP indicates C-Reactive Protein; ESR, Erythrocyte Sedimentation rate; MRSA, Methicillin Resistant *Saphylococcus Aureus*.

CRP indicates C-Reactive Protein; ESR, Erythrocyte Sedimentation rate; MRSA, Methicillin Resistant *Saphylococcus Aureus*.

All patients except one improved immediately after surgery. Monitoring was done clinically and hematologically. One patient developed quadriplegia 24-hour postsurgery in spite of initial improvement. On repeat MRI, he had epidural abscess and discitis at C6-C7 along with cord signal changes at C3 to D2 level and increased collection and involvement of adjacent vertebra. Imaging and neurological consultation pointed the possibility of anterior spinal artery occlusion or postinfective (dengue) demyelination. Re-exploration with epidural and prevertebral abscess drainage and anterior cervical discectomy and fusion (ACDF) of adjacent level was done (C6-C7). His neurological deficit improved progressively. Repeat MRI at discharge showed reduced signal changes as compared to previous studies with no epidural and paravertebral collection. On follow-up at 3 months, he is walking independently, although the walk is slow. He has grade 4 power for his right hand grip and near normal on the left.

All patients had very good neurological outcome. There was complete neurological recovery in all except one who was a quadriplegic (Frankel grade B). He recovered to near normal stage at six months after treatment. He walks independently and carries out his activities of daily life independently. He has some amount of residual spasm in his lower limbs and grade 4 power for his right hand grip. All patients had negative blood cultures after the treatment. One patient was put on anti-tubercular medicines.

This case report includes eight cases of epidural abscess with or without spondylodiscitis associated with other focal abscesses. All patients were diagnosed after 1 to 6 weeks of an episode of dengue fever. No blood or blood products were given to any of the patients.

There is no reason reported why the dengue virus has predilection for the neural tissue. A possibility of emergence of a neurotropic serotype needs to be further investigated.

CONCLUSION

This article reports high incidence of development of epidural abscess with or without spondylodiscitis in dengue-infected patient after a span of 1 to 6 weeks of asymptomatic period. The study in mice shows suppression of immunity through various mechanism. Infection with dengue virus will inhibit leucocyte migration and lymphocyte proliferation. Splenic T lymphocyte of infected mouse produces a CF that kills immune cells but not effective against bacterial cells. Splenic T lymphocyte also mediates antigen-specific suppression of IgM antibody forming cells.

Early diagnosis and treatment can prevent development of neurological deficits, septicemia, and death. Neurotropic nature of the dengue virus and its effect on immunity need further studies. Similar series of cases are not reported in literatures.

The predilection of dengue virus to the neural tissue and the disc space need further study. It may be attributable to the change in serotypes of the virus, which is getting evolved. The presence of multiple foci of infection in these cases points to the effect of the virus on the immunity, which needs

further studies. The rapid and excellent neurological recovery may be attributable to early diagnosis and immediate intervention. Whether it is related to some peculiarities of the dengue virus needs further studies.

From our study, there is evidence of manifestations of immunosuppression in other tissues or organs. One patient had septic shock, two patients had empyema with pleural effusion, one had left sternoclavicular joint abscess and septic arthritis of the knee, and one patient had concomitant tubercular infection.

➤ Key Points

- ❑ This is a large case series of epidural abscess with or without spondylodiscitis within 6 weeks following dengue virus infection.
- ❑ The predilection of dengue virus for the neural tissue should be further investigated.
- ❑ Post dengue immunosuppression also needs further study.

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References

1. WHO D. *Guidelines for Diagnosis, Treatment, Prevention and Control*. Geneva: TDR/WHO; 2009.
2. Kasper D, Fauci A, Hauser S, et al. *Harrison's principles of internal medicine*, 19e. USA2015. 2015, McGraw-Hill education. Part 8: Infectious diseases, Section 15: Infections due to RNA virus, Arthropod borne and Rodent borne diseases (233); p. 1322.
3. Brady OJ, Gething PW, Bhatt S, et al. Refining the global spatial limits of dengue virus transmission by evidence-based consensus. *PLoS Negl Trop Dis* 2012;6:e1760.
4. Gulati S, Maheshwari A. Atypical manifestations of dengue. *Trop Med Int Health* 2007;12:1087–95.
5. Suzuki S, Kitazawa T, Ota Y, et al. Dengue hemorrhagic shock and disseminated candidiasis. *Intern Med* 2007;46:1043–6.
6. Pancharoen C. Coinfections in dengue patients. *Pediatr Infect Dis J* 1998;17:81–2.
7. Thangaratham PS, Jeevan MK, Rajendran R, et al. Dual infection by dengue virus and *Plasmodium vivax* in Alappuzha District, Kerala, India. *Jpn J Infect Dis* 2006;59:211–2.
8. de Sousa AM, Alvarenga MP, Alvarenga RM. A cluster of transverse myelitis following dengue virus infection in the Brazilian Amazon Region. *Trop Med Health* 2014;42:115–20.
9. Jhamb R, Kashyap B, Ranga GS, et al. Dengue fever presenting as acute liver failure—a case report. *Asian Pac J Trop Med* 2011;4:323–4.
10. Lee K, Liu JW, Yang KD. Clinical characteristics, risk factors, and outcomes in adults experiencing dengue hemorrhagic fever complicated with acute renal failure. *Am J Trop Med Hygiene* 2009;80:651–5.
11. Lee K, Lee WH, Liu JW, et al. Acute myocarditis in dengue hemorrhagic fever: a case report and review of cardiac complications in dengue-affected patients. *Int J Infect Dis* 2010;14:e919–22.
12. Soares CN, Faria LC, Peralta JM, et al. Dengue infection: neurological manifestations and cerebrospinal fluid (CSF) analysis. *J Neurol Sci* 2006;249:19–24.
13. Seet RC, Lim EC, Wilder-Smith EP. Acute transverse myelitis following dengue virus infection. *J Clin Virol* 2006;35:310–2.

14. Bhatia K, Thakur M, Porwal YC, et al. Dengue hemorrhagic fever with multiple abscesses: an unusual presentation. *Int J Case Rep Images (IJCRI)* 2013;4:326–9.
15. Chanthamat N, Sathirapanya P. Acute transverse myelitis associated with dengue viral infection. *J Spinal Cord Med* 2010;33:425–7.
16. Seet RCS, Lim ECH, Wilder-Smith EPV. Acute Transverse myelitis following dengue virus infection. *J Clin Virol* 2006;35:310–2.
17. Chaturvedi UC, Tandon P, Mathur A. Effect of immunosuppression on dengue virus infection in mice. *J Gen Virol* 1977;36:449–58.
18. Mitrakul C. Bleeding problem in dengue hemorrhagic fever: platelets and coagulation changes. *Southeast Asian J Trop Med Public Health* 1987;18:407–12.
19. Srichaikul T. Disseminated intravascular coagulation in dengue hemorrhagic fever. *Southeast Asian J Trop Med Public Health* 1987;18:303–11.
20. Krishnamurti C, Peat RA, Cutting MA, et al. Platelet adhesion to dengue-2 virus-infected endothelial cells. *Am J Trop Med Hyg* 2002;66:435–41.
21. Srichaikul T, Nimmannitya S, Sripaisarn T, et al. Platelet function during the acute phase of dengue hemorrhagic fever. *Southeast Asian J Trop Med Public Health* 1989;20:19–25.
22. Lin C-F, Wan S-W, Cheng H-J, et al. Autoimmune pathogenesis in dengue virus infection. *Viral Immunol* 2006;19:127–32.
23. Lin SF, Liu HW, Chang CS, et al. Hematological aspects of dengue fever. *Gaoxiong Yi Xue Ke Xue Za Zhi* 1989 Jan; 5:12–16.
24. La Russa VF, Innis BL. Mechanisms of dengue virus-induced bone marrow suppression. *Baillieres Clin Haematol* 1995;8: 249–70.