

East African Medical Journal Vol. 90 No. 9 September 2013

CLINICAL FEATURES AND PATTERNS OF IMAGING IN CEREBRAL VENOUS SINUS THROMBOSIS AT KENYATTA NATIONAL HOSPITAL

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ABSTRACT

Background: Cerebral venous sinus thrombosis (CVST) is an uncommon neurological deficit. It shows a wide range of clinical manifestations that may mimic many other neurological disorders and lead to misdiagnosis. Imaging plays a key role in the diagnosis.

Objective: To evaluate the clinical characteristics and patterns of neuroimaging findings in patients with radiologically confirmed CVST.

Design: A retrospective study.

Setting: Kenyatta National Hospital, a tertiary referral and teaching hospital in Nairobi Kenya.

Subjects: Fifty one patients treated for CVST in the hospital were studied.

Results: Fifty one patients with CVST were seen over the last five years. The median age of 30 years. The most common age group affected was 25-34 years. Females were more affected (n=38, 74.5%) than males (n=13, 25.5%). The most common presenting clinical features documented were headache, seizures and neurological deficits. Aetiological factors commonly seen included infection (n=20, 39.2%), pregnancy and puerperium (n=7, 13.7%) and oral contraceptive use (n=2, 3.9%). The most common NECT scan findings were hyperdense sinus and parenchymal changes. MRI showed loss of signal void in the sinus, gyral swelling and parenchymal signal change.

Conclusion: CVST is most commonly seen in young adult females due to infection, pregnancy, puerperium and oral contraceptive use. The most common clinical finding in patients with CVST is headache, followed by seizures, neck pain, neurological deficits and visual disturbance. Infective cause is much more common in our population and other developed countries compared to the developed world.

INTRODUCTION

Cerebral venous sinus thrombosis is a relatively uncommon but serious neurologic disorder that is potentially reversible with prompt diagnosis and appropriate medical care (1). Because the possible causal factors and clinical manifestations of this disorder are many and varied, imaging plays a primary role in the diagnosis. Non-enhanced computed tomography (NE CT) and enhanced CT, Magnetic resonance imaging (MRI), TOF (time of flight) MR venography, and contrast enhanced MR venography and CT venography are particularly useful techniques for detecting cerebral venous

and brain parenchymal changes that are related to thrombosis.

The clinical presentation is highly variable. Most patients present with headache, seizures, focal neurologic deficit and visual disturbances.

There are about 100 known causes of CVST. Investigators of the International study for Cerebral Venous Sinus Thrombosis (ICVST) have shown that 44% of cases had more than one predisposing factor. Most common causes include deficiencies in antithrombin III, protein C and protein S, presence of factor V Leiden, oral contraceptive use, pregnancy and puerperium and CNS and head and neck infections and tumors. In about 15-25 cases no cause is found.

It is now known that MRI and MRV are the best imaging methods for demonstrating CVST. However because of the non-specific presentation most patients will have NECT as the first imaging study for evaluation of their neurological presentation. However it is important to appreciate that NECT is an unreliable tool for imaging patients with CVST. Even addition of contrast still misses 30% of cases. The time of flight (TOF) MRV studies show flow related imaging artifacts. Contrast enhanced MR venography gives superior depiction of the venous sinuses and shows small cortical veins to advantage.

CT venography is a rapid and readily available technique that depicts venous anatomy accurately. Recent comparative studies with MRV have shown that it has equivalent accuracy for detection of venous thrombosis with highly detailed depiction of cerebral venous anatomy superior to TOF MRV. The drawbacks of CTV include difficulty in reconstruction of MIP images with subtraction of bone and use of ionising radiation. CT venography and MR venography are the most reliable imaging tools, however they are uncommonly used.

MATERIALS AND METHODS

A five year retrospective cross sectional descriptive study was conducted at Kenyatta National Hospital. Clinical and imaging records of patients treated and followed up for CVST from September 2006 to September 2011 were obtained.

Imaging reports were obtained from radiology records and reviewed to identify file numbers. The files then were retrieved and clinical information obtained. Each patient's hospital number, age, sex and clinical feature were recorded. Review of all

available CT and MRI scans for the last five years was done and where cases were identified the files were obtained and reviewed.

Screening results for pre-thrombotic states and HIV status where available were recorded.

The X-Ray number was obtained from the radiology report from the file and then used to retrieve the imaging study for patients whose examination was done in KNH. For patients done elsewhere and for patients done in KNH but imaging study was not available credible report was obtained from the file. Cases where the imaging study or credible report was not available were excluded. Other files were obtained from the main records department using the International Classification of Diseases (ICD 10) for CVST. A total of 67 cases were identified but 16 were rejected due to missing imaging study or clinical records.

RESULTS

51 patients with CVST were seen with age range nine months to 80 years. Median age was 30 years. The most common age group affected was 25-34 years. Most cases of CVST occurred in patients' ages between 17 to 34 years (59.6%). This corresponds to data from other studies that have shown the commonest age group affected as 20-40 year old especially in females. There were only 5 (10.6%) patients in the paediatric age group (0 to 16 years) and this included a single infant aged nine months. There were no neonates. Females were more affected (n=38, 74.5%) than males (n=13, 25.5%). The proportion of female patients in the study was statistically significantly higher than that of male patients (difference = 49%, 95% CI 32.1% to 65.9%, $p < 0.001$).

Figure 1
Age distribution of patients with CVST.

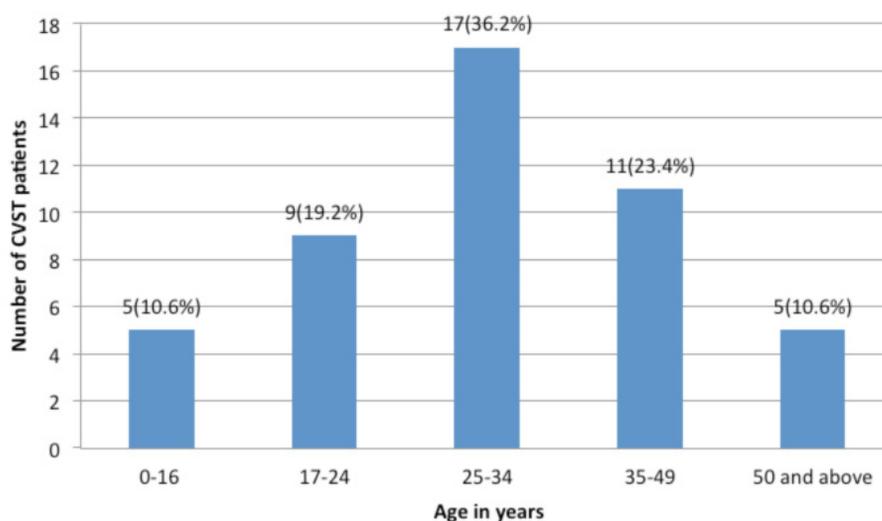
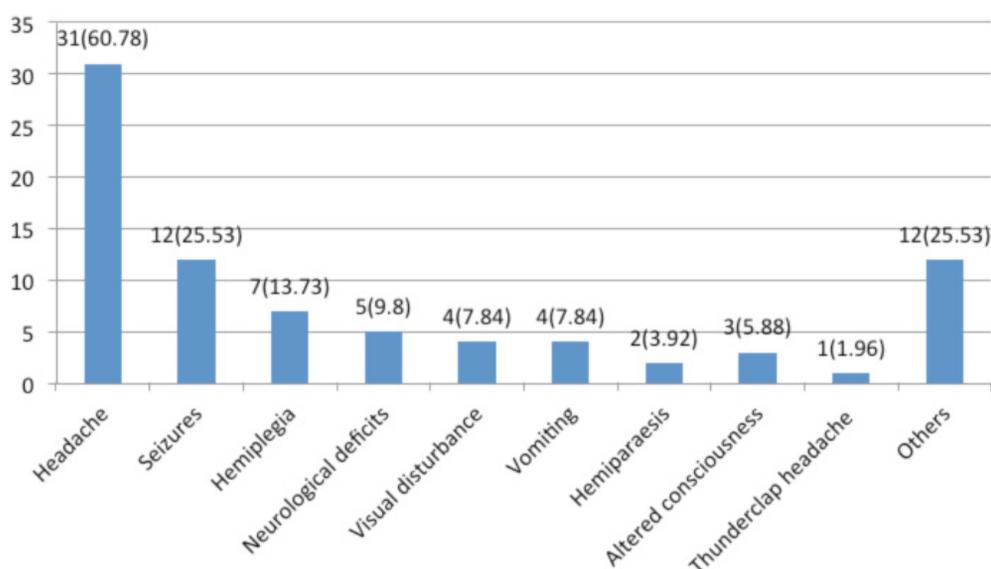


Table 1
Distribution of patients age according to gender

Age group	Male	Female	Total	P value (Fisher's test)
0-16 years	1(20)	4(80)	5(100)	0.082
17-24 years	2(22.22)	7(77.78)	9(100)	
25-39 years	5(29.41)	12(70.59)	17(100)	
35-49 years	0(0)	11(100)	11(100)	
50 years and above	3(60)	2(40)	5(100)	

Figure 2
Clinical presentation of CVST patients at KNH



Clinical presentation: As shown in Figure 2, CVST most commonly presented either as a headache (60.78%) or seizures (23.53%). The next most common clinical presentation was neurological deficit affecting a total of 14 patients. Among these patients seven (13.73%) had hemiplegia, two (3.92%) had hemiparesis and 5 (9.8%) had focal neurological deficits. No patients presented with speech defects. Vomiting, visual disturbance, altered consciousness not including coma, thunderclap headache each affected less than 10% of patients. Twelve (23.53%) patients presented with other complaints, most commonly neck pains (n = 5, 9.8%). The other presentations affecting a single patient each were confusion, syncope, papilloedema, loss of memory, abdominal pain and senile dementia.

Aetiological factors commonly recorded included infection (n=20,39.2%), pregnancy and puerperium (n=7,13.7%), oral contraceptive use (n=2,3.9%) and

associated DVT (n=2, 3.9%). Of the infective causes meningitis (13.73%) was the most common condition followed by sinusitis (7.84%). Other conditions included mastoiditis 2(3.96%), metastasis 2(3.96%), encephalitis 1 (1.96%) and trauma 1(1.96%). This is at variance with findings in other studies where infective causes have been shown to account for only 8.2%.

Out of the 51 patients in the study the HIV status of 16 (31.37%) patients was known while for 35 (68.63%) no screening results could be obtained. For the 16 patients for whom HIV status was known 11 tested negative while five were HIV positive. Therefore the actual prevalence of HIV among these patients could not be obtained. However the percentage of patients with HIV who also had co-morbid illness was significantly higher (80%) than that of patients without HIV (18.18%). This then may increase the risk of CVST in patients infected with HIV.

Table 2
CT findings among patients with CVST at KNH

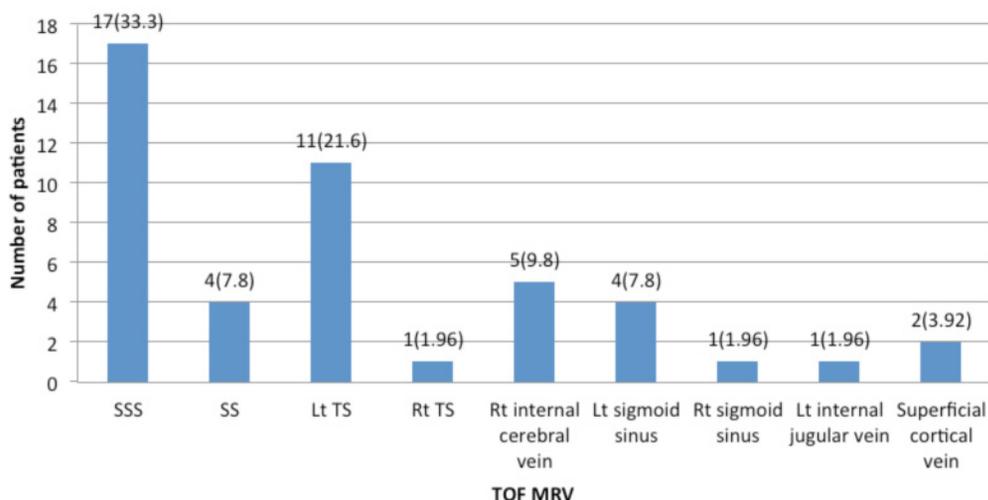
	Number (%)
Parenchymal changes	
Parietal	19 (37.25)
Frontal	12 (23.53)
Occipital	5 (9.8)
Temporal lobe	3 (5.88)
Parasagittal	2 (3.92)
Thalamus	2 (3.92)
Pons	1 (1.96)
Brain oedema	12(23,53)
Presence of haemorrhage	6 (11.76)
CET Findings	
Empty delta sign	16 (31.37)
Non-enhancing sinus	3 (5.88)
Both empty delta and non-enhancing sinus	8 (15.69)
Any documented CET finding	27 (52.94)

CT Scan Findings: Brain CT was done in 39 out of the 51 patients in the study with 23 (45.10%) patients showing parenchymal changes. As shown in Table 2 the most common sites of parenchymal changes were the parietal (37.25%) and temporal (23.53%) areas. NECT signs of thrombosis were observed in 23 patients, 19 (37.25%) patients had hyperdense sinus and 4 (7.84%) had both cord signs and hyperdensesinus. Nineteen patients had parenchymal changes in the hemispheres with the left side being affected more commonly (n =15) than the right side (n = 4). Out of 27 (52.94%) patients with documented

CET finding, 16 had empty delta sign and 3 had non enhancing sinus, and 8 patients had both signs. The most commonly affected sinus was the superior sagittal sinus followed by the transverse sinuses.

MRI Findings: 19 patients had MRI done. MRI sinus signal was predominantly hyperintense on both T1W1 (13.73%) and T2WI (11.76%) indicating subacute thrombus with loss of signal void. In both sequences brain oedema was the next most common finding: Haemorrhagic infarcts were observed in 7.84% of scans on T1W1 and T2WI images.

Figure 5
TOF MRV



TOF MRV: As shown in Figure 5, the most commonly affected sites on MRV were SSS followed by the left TS. These two sites showed changes in 17 (33.3%) and 11 (21.6%) patients, respectively. The other sinus sites with changes in a significant number of patients were the right internal cerebral vein (9.8%, n = 5), left sigmoid sinus (7.8%, n = 4) and SS (7.8%, n = 4). Representative images are shown below;

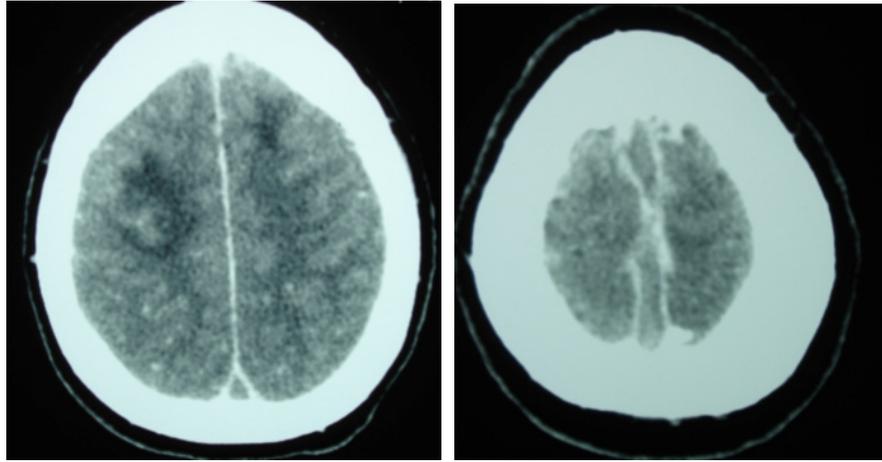


Illustration 1: 34 year old female with seizures and h/o oral contraceptive use. Empty delta sign in the SSS and non-enhancement of the sinus are seen. Bilateral parietal parenchymal changes are seen with haemorrhagic transformation on the right.

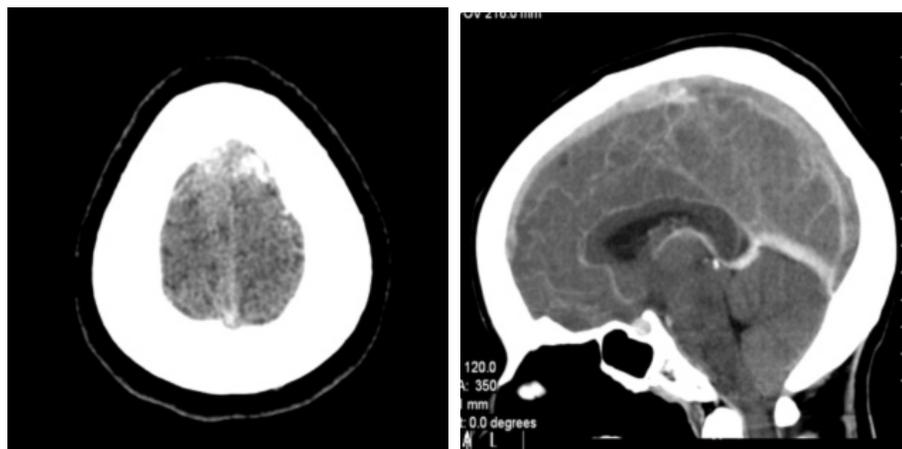
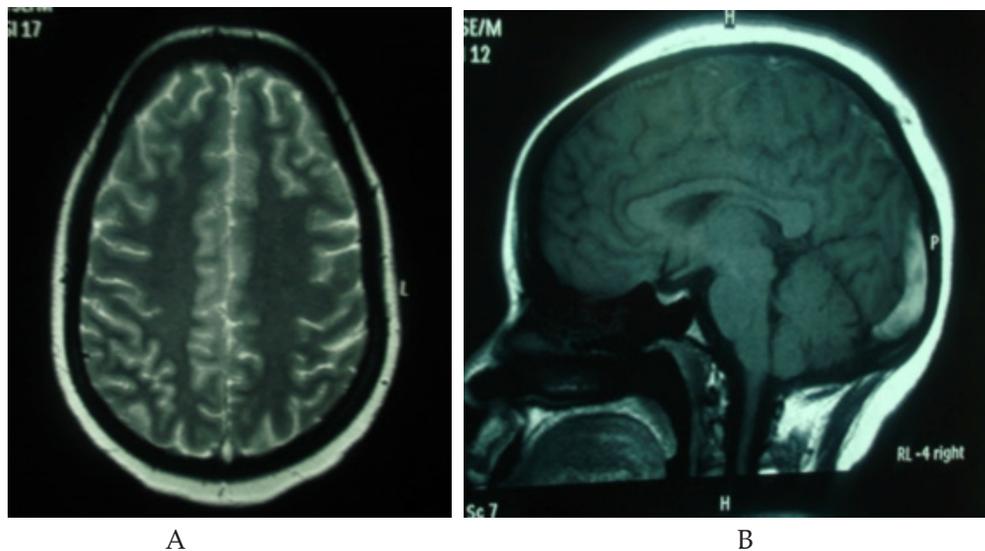


Illustration 2: A 33 year old female who presented with h/o severe headache. Axial NECT shows dense cord sign in the superficial cortical veins. CECT shows non-enhancement of the posterior SSS.



A

B



C

Illustration 3: A 33 year old female with h/o headache . There is loss of the signal void in the SSS (A and B). MRV done showed non-visualisation of the SSS and the right TS.

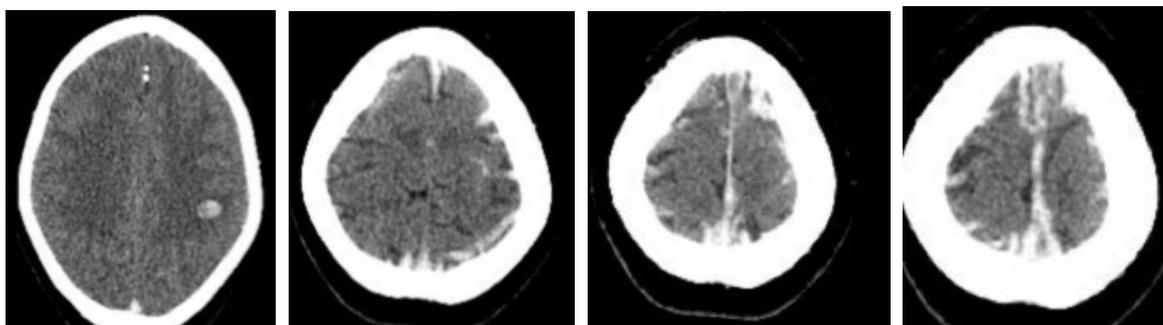


Illustration 4: 18 year old girl on treatment for DVT, who presented with seizures and syncope. NECT (A, B and C) shows 'dense cord sign' , left parietal parenchymalhaemorrhage and brain oedema. CECT (D) shows empty delta sign.

DISCUSSION

Cerebral venous sinus thrombosis affects all age groups but is most common in young adults and especially females. In this study females were more commonly affected than males especially in the age range 17-39 years. This correlates well with studies done elsewhere that have shown female preponderance (1, 2). The male patients seen did not show a particular age predominance indicating similar risk across the age groups.

The most common presenting complaint of CVST in this study was headache. This correlates well with other studies done elsewhere which have shown headache as the most common presenting complaint (3, 4, and 9). One patient presented with thunder clap headache and was initially worked up as a case of subarachnoid haemorrhage and was actually booked for four vessel angiogram. This was however obviated when CVST was diagnosed on CECT. This corresponds to other studies which have shown that thunderclap headache occasionally occurs in CVST (2, 3). This entity can therefore be considered in the differential diagnosis of patients being evaluated for subarachnoid haemorrhage.

Other presenting complaints in order of frequency include; seizures, visual disturbance, neck pains and vomiting. The common examination findings documented include hemiplegia, focal neurological deficits, hemiparesis and altered consciousness. This correlates well with what has been seen in other studies (1, 2).

The most common aetiological factor seen was infection. This is at variance with other large studies by Ferro et al from Europe and South America and Wasay et al from US which have shown thrombophilia as the commonest cause. It however correlates well with a large study by Khealani in Pakistan and Middle East that showed infection as the commonest cause (5). This indicates a higher infective etiology in developing countries.

Among the patients whose HIV status was known presence of HIV was associated with a higher likelihood of having co-morbid conditions especially infection . This then may increase the risk of CVST in HIV positive patients.

The most common NECT finding was hyperdense sinus and cord sign. Parenchymal changes and brain oedema were seen in more than 50% of cases. This agrees with other studies that showed venous infarct

in over 50% of cases. It is however now agreed that parenchymal changes are not purely venous infarction but a combination of vasogenic oedema, cytotoxic oedema and infarction. Haemorrhagic parenchymal changes were seen in six cases.

CECT findings included empty delta sign in 16 cases followed by non enhancing sinus in three cases. Thus the empty delta sign was seen in 31% of cases. This agrees with most studies which have shown delta sign in 33% (5, 14, and 21).

The commonest finding on MRI was hyperintense thrombus with loss of signal void. This indicates most of these cases were seen in the subacute stage. TOF MRV showed filling defects in the sinuses.

No CT venographic imaging study was documented. This is likely due to lack of awareness on the utility of this modality for evaluation of CVST. This article will help raise awareness on this modality as it is cheaper and more readily available than MRI and has comparable diagnostic quality.

Although this study cannot claim to have discovered all cases of sinus thrombosis due to the sometimes non-specific presentation which may not have resulted in imaging and hence the diagnosis, we do not think this group was large enough to bias our results. A prospective study would answer some of our unanswered questions. Retrospective data has major flaws but we excluded as many patients with incomplete data as possible.

The most commonly affected sinus on both CT and MRI/MRV was the SSS. This was followed by the transverse sinuses. The sigmoid and straight sinuses and internal cerebral and Great cerebral vein of Galen were less commonly involved. This correlates well with studies done by Ameri and Ferro *et al.* No case of cavernous or inferior sagittal sinus thrombosis was documented in this study.

CONCLUSION

CVST is most commonly seen in young adult females due to infection, pregnancy, puerperium and oral contraceptive use. The most common clinical finding in patients with CVST is headache. This is followed by seizures, neck pain, neurological deficits and visual disturbance. These clinical features are non-specific therefore we need to maintain a high index of suspicion.

Infective cause is much more common in our population compared to other regions. Thus CVST should specifically be sought in patients with CNS imaging studies in the right clinical setting.

CVST is well demonstrated on neuroimaging studies of NECT, CECT, CTV and MRI/MRV therefore radiologists should maintain a high index of suspicion for dural sinus thrombosis especially for young adult females with headache and other non-specific clinical presentations.

CT venography should also be considered for imaging patients with CVST as it is cheaper than MRI and has comparable diagnostic quality.

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