

## Original Research Article

# Evaluation of cerebral venous thrombosis by computed tomography/MRI and magnetic resonance venography in pregnant and postpartum women: a prospective study

Neelam Singh<sup>1</sup>, Dinesh Udainiya<sup>2\*</sup>, Sonal Kulshreshtha<sup>1</sup>, Jyoti Bindal<sup>1</sup>

<sup>1</sup>Department of Obstetrics and Gynecology, G. R. Medical College, Gwalior, Madhya Pradesh, India

<sup>2</sup>Department of Neurology, GRMC, Gwalior, Madhya Pradesh, India

**Received:** 01 August 2018

**Accepted:** 31 August 2018

### \*Correspondence:

Dr. Dinesh Udainiya,

E-mail: [drdineshudainiya@gmail.com](mailto:drdineshudainiya@gmail.com)

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## ABSTRACT

**Background:** Diagnosis of Cerebral venous thrombosis (CVT) is challenging as it is an uncommon cause of stroke with varied clinical presentations, predisposing factors, imaging findings, and outcomes. Prompt and accurate diagnosis is important for timely intervention in order to reverse and significantly reduce the acute and long-term sequel. Aims and objectives was to study cerebral venous thrombosis in pregnant and post-partum women.

**Methods:** Hundred pregnant and postpartum women having CVT were studied at Kamla Raja Hospital and JA Group of Hospital at GR Medical College, Gwalior Madhya Pradesh for study period of 2016 to 2017. All the women had undergone CT/MRI and MRV.

**Results:** Age of CVT patients ranged from 18-35 years with a maximum incidence (84%) in the 2<sup>nd</sup> decade (20-30 years). Sixty two percent women had infarction; out of that 53% had hemorrhagic infarction. Frontal lobe (10%) and temporal lobe (10%) were more affected. Superior sagittal sinus (SSS) was most commonly involved (71%) followed by transverse sinus (66%) and sigmoid sinus (45%). Superficial venous system was involved in 32 patients while deep venous system was involved in 20 patients. Majority of (82%) patients had combination of sinuses and venous involvement.

**Conclusions:** CVT was more prevalent in young pregnant and postpartum women. Hemorrhagic infarction were common and affecting frontal and temporal lobe. SSS were mostly affected in CVT. MRV should be the first line diagnostic tool for diagnosis of CVT in pregnant and postpartum women.

**Keywords:** Haemorrhagic infarction, Pregnancy, Neuroimaging

## INTRODUCTION

CVT has been recognized since the early 19<sup>th</sup> century but still remain a diagnostic and therapeutic challenge because of wide variety of clinical presentations, course and outcome.<sup>1</sup> Cerebral vein and sinus thrombosis is rare compared to arterial stroke, often occur in young individuals.<sup>2</sup> Most reported cases were in puerperal women.<sup>3</sup> CVT forms a distinct subgroup of cerebrovascular disease in India and is leading cause of

mortality in women of reproductive age group.<sup>3</sup> In India, most of the cases are seen in postpartum period in women, while alcoholism is a significant risk factor in male.

Outcome of cerebral venous thrombosis is highly unpredictable and it is not unusual to see dramatic recovery in deeply comatose patient and sudden worsening in conscious patients due to extension of thrombosis. With the advent of imaging modalities like

CT scan and recently Magnetic Resonance Imaging (MRI) and Magnetic Resonance Venography (MRV), the diagnosis of CVT has improved significantly.

CT scan commonly shows haemorrhagic infarctions with or without “cord”, or “empty delta” sign. MRI and MRV, when used in doubtful situations can clarify the diagnosis by showing thrombosed sinus of cortical veins.<sup>4,5</sup>

In fact after the introduction of MRI, many of the patients earlier diagnosed as idiopathic intracranial hypertension have been noted to have sinus thrombosis. Pathologically involvement of superior sagittal sinus of varying extent with or without the involvement of transverse and sigmoid sinuses with thrombosis of cortical veins had been reported commonly.<sup>2,3</sup>

However, data is limited on the neuroimaging of CVT in pregnant and postpartum women, hence in present study we tried to evaluate cerebral venous thrombosis by CT/MRI and MRV in pregnant and postpartum women.

## **METHODS**

The present prospective cross-sectional study was performed on hundred (100) pregnant and postpartum women who were having cerebral venous thrombosis which was confirmed by computed tomography (CT), Magnetic Resonance Imaging (MRI)/Magnetic Resonance Venography (MRV) at Kamla Raja Hospital and JA Group of Hospital at GR Medical College, Gwalior Madhya Pradesh for study period of January 2016 to June 2017. The study place was a tertiary care hospital. Study period was From January 2016 to June 2017.

### **Study population**

Hundred (100) pregnant and postpartum women with cerebral venous thrombosis (CVT) were included. Written informed consent was obtained from each woman before starting the study.

### **Inclusion criterion**

Pregnant women and postpartum (6 weeks) women with features of neurological deficit and raised intracranial pressure and patients giving a written informed consent were included in the present study.

### **Exclusion criterion**

Patients of cerebral venous thrombosis due to arterial stroke, cardioembolus stroke, nephrotic syndrome, cancer, head injury, neurosurgical procedures and any trauma were excluded from the present study. Patients who had not given the written informed consent were also excluded from the present study.

A detailed demography including age and sex, type of infarction, affected lobe and site of thrombosis were recorded in preapproved proforma.

All patients underwent comprehensive CT/MRI and MRV. It was done for all the women. All the findings and etiology for the cause of CVT was entered in preapproved proforma.

All the data analysis was performed using IBM Statistical Package for the Social Sciences (SPSS) ver. 20 software. Frequency distribution and cross tabulation was used to prepare tables in IBM SPSS Ver.20. Microsoft excel 2010 was used to record the data and to prepare the graphs wherever required. Categorical data is expressed as number and percentage. Frequency distribution and cross tabulation was used to prepare table. Microsoft excel 2010 was used to prepare the graphs.

## **RESULTS**

In present study, maximum patients were in 2nd decade of their age (84%) followed by 12 patients who were >30 years of age. In age group of <20 years there were 4 patients.

In present study, maximum number of patients (n=58) come direct, while 42 patients are referred from various centre with feature suggestive of cerebral venous thrombosis (CVT). Only 4 patients were booked during their antenatal period, while majority (n=96) were unbooked. They have less ANC visit. Maximum number (n=95) of patients presents in postpartum period. Only 5 cases present in antepartum period.

Infarction was present in 62% of them out of which 53 had haemorrhagic infarction and 9 patients had non haemorrhagic infarction according to the site. Most common affected lobe was frontal (10%) and temporal (10%) followed by frontal and occipital (6%) and occipital and parietal (6%). Other than infarction, abnormalities noted on CT scan were mass effect and diffused edema (2%).

Superior sagittal sinus (commonest sinus involved) was involved in 71 patients, isolated SSS in 10 patients. Total involvement was seen in 53 patients while in other patients anterior, middle and posterior parts involved with various combination of other sinuses. Transverse sinus was the next most common sinus involved in 66 patients (isolated in 8 patients) followed by sigmoid sinus 45 patients. Superficial venous system was involved in 32 patients while deep venous system was involved in 20 patients. Majority of (82) patients had combination of sinuses and veins involvement. 18 patients had only isolated sinus involvement.

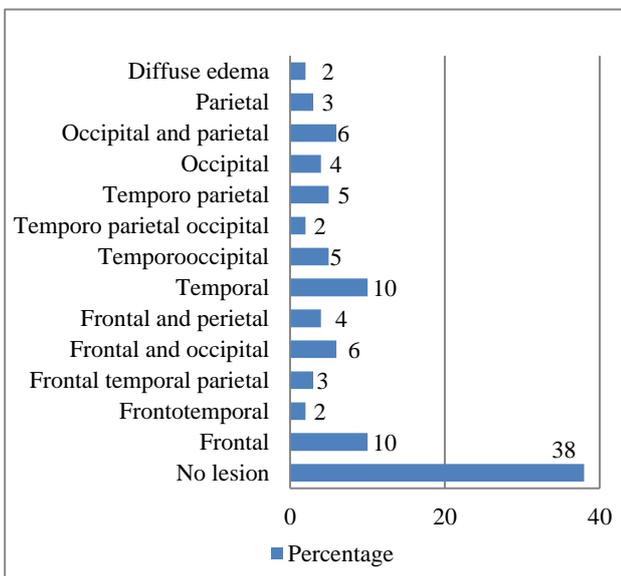
Table 1 shows the distribution of patients according to MRV finding (Site of thrombosis). Most common site of thrombosis was superior sagittal sinus, transverse sinus,

sigmoid sinus together (16%) followed by superior sagittal sinus and transverse sinus (14%). Most common CT scan/MRI finding in present study was temporal (10%) and frontal (10%) followed by occipital with parietal (6%) and frontal with occipital (6%) (Figure 1).

**Table 1: Distribution of patients according to MRV finding (site of thrombosis).**

MRV findings	Percentage (%) (n=100)
SSS	12
SSS and TS	14
SSS, TS, SS, straight sinus, cortical vein	5
SSS, TS, SS	16
SSS, TS, deep vein	2
SSS, SS, deep vein	6
SSS, cortical vein	6
SSS, TS, SS, deep vein	2
SSS, IJV, cavernous sinus	6
TS	8
SSS, TS, SS, straight sinus	2
TS, SS	10
TS, SS, deep vein	2
SS, TS, IJV	2
Cortical vein	4
TS, straight sinus, IJV	3

Data is expressed as percentage, SSS; superior sagittal sinus, TS; transverse sinus, SS; sigmoid sinus, IJV; internal Jugular vein, MRV; Magnetic Resonance Venography



**Figure 1: Distribution of patients according to CT scan/MRI findings.**

**DISCUSSION**

CVT is an important consideration in pregnant and postpartum women who present with headache or focal neurologic deficits.<sup>6</sup> Several reports have shown that

CVT is more prevalent in Indian population and is associated with postpartum state.<sup>7-9</sup> Availability of neuroimaging techniques has made the diagnosis of CVT in both the genders and at an early stage in Indian population.<sup>10</sup> Previous studies has revealed that 60-79% patients of CVT are women and reported to be the most common cause of young women stroke.<sup>4</sup>

The possible cause of this is may be due to the high prevalence of postpartum hypercoagulable state which is precipitated in the presence of dehydration and consumption of high fat food during peripartum period.<sup>11</sup> In present study pregnant and postpartum women who were having CVT were studied for type of infraction, lobe involved and sinus involvement.

Panagariya et al, evaluated 64 cases of CVT in pregnancy and puerperium and reported that majority of them were below 25 years of age which is in accordance to present study finding where maximum women were in 2<sup>nd</sup> decade of their age (84%).<sup>12</sup>

Diagnosis of CVT can be made from CT scans that may manifest venous infarcts or its specific hemorrhages. Suspicion of CVT should be made if presence of multiple hemorrhagic infarctions is reported without a source of embolism or atherothrombosis.<sup>13,14</sup> However, sensitivity of CT scan is poor and shows direct signs of CVT in less than half of the cases.<sup>15</sup> In present study, CT scan has revealed that most common infarction was haemorrhagic (53%) which is higher than the reports of Nagaraja et al (40.9%).<sup>3</sup> Sasikala et al, studied 52 pregnant women with CVT also reported haemorrhagic infarction (84.3%) as the most common finding.<sup>16</sup> Study done by Cantu et al, reported lower incidence of haemorrhagic infarction (35.5%) as revealed by present study.<sup>17</sup> In agreement to present study Narayan et al did the CT scan of 293 out of 428 patients of cerebral sinus venous thrombosis and revealed that 58.7% patients were having hemorrhagic infarction (58.7%).

No one can rule out CVT with a normal plain brain CT or MRI, and venographic imaging should always be performed in probable cases, while it may also help distinguish normal anatomic variants like hypoplastic sinus.<sup>18</sup> The American heart association/American stroke association 2011 scientific statement recommended magnetic resonance with T2 weighted imaging and MR venography as the imaging test of choice for evaluation of suspected CVT.<sup>18</sup> Sasikala et al, revealed that most common site of thrombosis was superior sagittal sinus (65%) followed by Lateral sinus (60%) and Sigmoid sinus (36%).<sup>16</sup> In agreement to Sasikala et al, in present study superior sagittal sinus was most commonly involved (71%) followed by transverse sinus (66%) and sigmoid sinus (45%).<sup>16</sup> Similar to present study, Cantu et al, showed that most common site of thrombosis was, superior sagittal sinus (89.5%) followed by transverse sinus (34.3%) and deep venous sinus (25.3%).<sup>17</sup> Reports of Cakmak et al and Treadwell et al are also consistence

with the reports of present study in terms of site of thrombosis.<sup>19,20</sup> Narayan et al, did MRV in 412 patients and showed that superficial venous system was involved in 97.8% and deep venous system in 5.8% patients.<sup>11</sup> A study from Iran by Kasmaei et al, studied 19 women admitted to the emergency department with the diagnosis of CVT reported that superior sagittal and right transverse sinuses were the most commonly involved. Multiple sinuses were involved in five patients (26.3%).<sup>18</sup>

## CONCLUSION

Obstetric CVT most commonly presents during the puerperal period and is one of the major causes of stroke in young women especially in the 2<sup>nd</sup> decade of age. Diagnosis of CVT is challenging because of wide spectrum of clinical profile and need of high index of suspicion. Use of neuroimaging such as MRI and MRV has revolutionized diagnosis and should be used as the first line diagnostic tool for pregnant and postpartum women.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

- Ribes M. Des recherches faites sur la phlébite. *Revue Médicale Française et Étrangère et J Clinique de L'Hôtel-Dieu et de la Charité de Paris.* 1825;3:5-41.
- Boussier MG, Chiras J, Berics J, Castagne P. Cerebral venous thrombosis-a Review of 38 cases. *Stroke* 1985;16(2):199-213.
- Nagaraja D, Taly AB. Puerperal venous sinus thrombosis in India. In: *Sinhakked Progress in Clinical Neurosciences*, Ranchi NSI, Publications. 1985;5:165-77.
- Bansal BC, Gupta RR, Prakash C. Stroke during pregnancy and puerperium in young females below the age of 40 years as a result of cerebral venous/sinus thrombosis. *J Heart J.* 1980;21:171-83.
- Ein Haupl KM, Villringer A, Meister W, Mehracin S, Garner C, Pellkofer M, et al. Heparin treatment in sinus thrombosis. *Lancet.* 1993;38:597-600.
- Lee I, James Leach, Thomas Tomsick, Matthew L. Flaherty. Pearls and Oysters: cerebral venous sinus thrombosis involving a persistent falcine sinus. *Neurology.* 2015;85:e162-4.
- Nagpal RD. Dural sinus and cerebral venous thrombosis. *Neurosurg Rev.* 1983;6:155-60.
- Srinivasan K, Natarajan M. Cerebral venous and arterial thrombosis in pregnancy and puerperium. *Neurol India.* 1974;22:131-40.
- Srinivasan K, Natarajan M. Cerebral venous and sinus thrombosis in pregnancy and puerperium. A study of 135 patients. *Angiology.* 1983;34:731-46.
- Ferro JM, Correia M, Ponter C. For ISCVT investigators. Prognosis of cerebral venous and dural sinus thrombosis, results of ISCVT. *Stroke.* 2004;35:664-70.
- Narayan D, Kaul S, Ravishankar K, Suryaprabha T, Bandaru VCSS, Mridula KR, et al. Risk factors, clinical profile, and long-term outcome of 428 patients of cerebral sinus venous thrombosis: insights from Nizam's Institute Venous Stroke Registry, Hyderabad (India). *Neurol India.* 2012;60(2):154-9.
- Panagariya A, Maru A. Cerebral venous thrombosis in pregnancy and puerperium-a prospective study. *J Assoc Physicians India.* 1997;45(11):857-9.
- Kasmaei HD, Baratloo A, Soleymani M. A 33-year-old woman with severe postpartum headache. *Emergency.* 2013;1(1):27-9.
- Rizzo L, Crasto SG, Ruda R, Gallo G, Tola E, Garaballo D et al. Cerebral venous thrombosis: role of CT, MRI and MRA in the emergency setting. *Radiol Med.* 2010;115(2):313-25.
- Saposnik G, Barinagarrementeria F, Brown RD, Jr, Bushnell CD, Cucchiara B, Cushman M, et al. Diagnosis and management of cerebral venous thrombosis: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke J Cerebral Circulation.* 2011;42(4):1158-92.
- Sasikala R, Jagan A, Dilshath S. Clinical profile of cerebral venous thrombosis in pregnancy and puerperium in South India. *Inter J Reprod Contra Obs Gynaecol.* 2017;6(7):3124-8.
- Cantu CC, Barinagarrementeria F. Cerebral venous thrombosis associated with pregnancy and puerperium: Review of 67 cases. *Stroke.* 1993;24:1880-4.
- Kasmaei HD, Baratloo A, Nasiri Z, Soleymani M, Shirafkan A, et al. Report of nineteen cerebral vein thrombosis referrals to an emergency department: a case series and literature review. *Arch Neurosci.* 2015;2(2):e20552.
- Cakmak S, Hermier M, Montavont A, Derex L, Manguière F, Trouillas P, et al. T2 weighted MRI in cortical venous thrombosis. *Neurol.* 2004;63(9):1698.
- Treadwell SD, Thanvi B, Robinson TG. Stroke in pregnancy and the puerperium. *Postgrad Med J.* 2008;84(991):238-45.

**Cite this article as:** Singh N, Udainiya D, Kulshreshtha S, Bindal J. Evaluation of cerebral venous thrombosis by computed tomography/MRI and magnetic resonance venography in pregnant and postpartum women: a prospective study. *Int J Res Med Sci* 2018;6:3381-4.