

## A Clinical Review of Pregnancy with Spontaneous Intracranial Bleed in a Tertiary Care Hospital

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Conflict of interest: Nil

### Abstract:

**Background:** Though Pregnancy is physiological; it remains as a risk factor for stroke, and hemorrhagic stroke accounting for 60% of the strokes. It may occur during of 6 weeks postpartum period. Intra Cranial Haemorrhage (ICH) has a high case-fatality rate. Women experiencing ICH are at much higher risk for preterm birth. Aim of the Study: to elucidate pregnancy-associated stroke using the Inpatient Sample by estimating the changes in overall pregnancy associated stroke as well as stroke with and without hypertensive disorders of pregnancy; identifying the stroke risk factors play a role in these hypertensive disorders of pregnancy and stroke.

**Materials:** A cross sectional study undertaken with 41 pregnant women who developed spontaneous stroke. Demographic data collected, ICD9 classification used for strokes, investigations done, neurosurgical measures undertaken in all. The course of stay, prognostic data was analysed using standard statistical methods.

**Results:** 41 pregnant women with Spontaneous stroke were included; the mean age was 21.35±2.40 years. 16 (39.02%) women developed ICH due to SAH. Intra-parenchymal Hemorrhage (IPH) was noted in 12 (29.26%), Sub Dural hemorrhage was noted in 09 (21.95%) of the total women. Extra Dural hemorrhage was noted in 04 (9.75%) women. There was no significant relationship between ages, gestational age, status of their gravida, and status of their Para, mode of delivery or admission week after delivery. ( $P > 0.05$ )

**Conclusions:** Spontaneous hemorrhagic stroke is a therapeutic emergency. During pregnancy the maternal and fetal prognosis are involved. The multidisciplinary management allows one to find the best compromise between the requirements imposed by the state of the mother and those related to the presence of fetus.

**Keywords:** Stroke, Pregnancy, Intracranial Bleed, Subdural Hematoma and Termination of Pregnancy.

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### Introduction

Cerebrovascular attack in pregnant women could be devastating for both the mother and the child. It could be a stroke or haemorrhagic episode. [1] The World wide statistics of strokes in pregnant women amounted to 34.2 per 100,000 deliveries with a mortality rate of 1.4 per 100,000 (2) The figure included both types (stroke and ICH).

The main causes of ICH were found to be vascular anomalies, preeclampsia/ eclampsia, and coagulopathies. [3,4] Among the causes of ICH, Aneurysmal subarachnoid hemorrhage (SAH) was found to be having lowest risk during pregnancy, labor, or puerperium (RR 0.40, 95% CI 0.20–0.90). [5] ICH bleeds could be Intraparenchymal hemorrhage (IPH) or intracerebral hemorrhage and subdural hemorrhage (SDH) and each one of them have definite identifiable etiologic factors. [6] 24% of ICHs could result from unknown causes. [4]

ICHs of unknown aetiology are termed as spontaneous variety. Risk factors of spontaneous ICHs are Headache, Migraine, thrombophilia, Systemic lupus erythematosus, cardiac diseases, sickle-cell disease, preeclampsia, gestational hypertension, thrombocytopenia, postpartum hemorrhage, transfusion, and postpartum infection [1,2]. The most common cause of IPH is arteriovenous malformations (AVMs), [1]. The less common aetiological factors of IPH are Moyamoya disease and cerebral venous sinus thrombosis.

The pathophysiology and etiology of spontaneous ICH is different from the other types of ICH because they do not relate to a specific structural abnormality. [7] In addition to neurosurgical methods of treatment spontaneous intra cerebral bleeds require special treatment if occurs in pregnant women and remains as a challenge to both

the specialists. The gravid nature of the uterus, radiological investigations have to be limited in the diagnosis of the strokes in pregnant women. Lack of standard protocol to treat ICH in pregnant women makes it difficult to treat and to create standard management guidelines. [8] Both the mother and fetus have to be assessed in parallel during the entire course of treatment to optimize the management. In case premature delivery is planned to avoid maternal mortality, the age of the fetus must be correctly assessed as well as assess the risks of expected of the termination of pregnancy for the parturient. [9]

In India it was observed that the preeclampsia incidence also increased by 15%. [10] In the present context in this study with an aim to elucidate pregnancy-associated stroke using the Inpatient Sample by estimating the changes in overall pregnancy associated stroke as well as stroke with and without hypertensive disorders of pregnancy; identifying the stroke risk factors play a role in these hypertensive disorders of pregnancy and stroke.

## Materials and Methods

**Type of study:** A cross sectional study

**Period of study:** June 2022 to Dec 2023

41 pregnant women were included in the study that were attending the departments of OBG and referred to Departments of Neurosurgery for the treatment of stroke were included. An approval from the ethics committee of the institute was obtained and consent was obtained from the attendants of the patients. The MRD data of previous patients was obtained from the Kannur Medical College and Hospital, Anjarakandy, Kannur.

**Inclusion Criteria:** Pregnant women of all child bearing ages (15 to 44 years) were included. Pregnant women with pregnancy of all terms were included. Postpartum women up to 6 weeks with stroke were included.

**Exclusion Criteria:** Pregnant women with previous history of stroke, head injuries, skull surgeries were excluded. Patients with autoimmune diseases, Diabetes mellitus and very low BMI were excluded.

Pregnant women admitted for nonpyogenic thrombosis of intracranial venous sinus (437.6), phlebitis and thrombophlebitis of intracranial venous sinuses (325) and peripartum phlebitis and thrombosis, cerebral venous thrombosis, and thrombosis of intracranial venous sinus (671.5) were excluded because these conditions do not necessarily result in a stroke.

All the clinical diagnoses of spontaneous strokes in pregnant women were classified under ICD

classification (ICD-9-CM) codes. The following ICD-9-CM codes listed at any position were used to identify diagnoses of ischemic stroke (433.01, 433.10, 433.11, 433.21, 433.31, 433.81, 433.91, 434.00, 434.01, 434.11, 434.91, and 436), subarachnoid hemorrhage (430), intracerebral hemorrhage (431), and transient ischemic attack (435) were included. Non-delivery admissions during pregnancy were termed as Antenatal hospitalizations and postpartum hospitalizations separately maintained for strokes. The above classification was grouped again for analysis based on stroke subtype: 1. hemorrhagic stroke (subarachnoid hemorrhage and intracerebral hemorrhage), 2. Ischemic stroke and other 3. Transient ischemic attack & unspecified stroke. Pregnant women with hypertension admitted for stroke were classified as per ICD-9-CM codes: 642.0x, 642.1x, 642.2x, 642.3x, 642.4x, 642.5x, 642.6x, 642.7x, 642.9x, and 401.x-405.xx. The ICD-9-CM code 780.39 was used to indicate stroke-associated seizure and code 642.6 for seizure indicating Eclampsia. Statistical Analysis: Orthogonal polynomial coefficients were calculated recursively by the method of Fisher and Yates for linear trend testing. The significance level used to test linear trends was set at 99% (ie,  $P=0.01$  threshold). Odds ratios (ORs) and their 95% confidence intervals (CIs) were obtained from multivariable logistic regression analysis.

## Results

Among the 41 pregnant women with strokes included in this study, 05 (12.19%) were aged 18 to 24 years, 014 (34.14%) were aged 25 to 34 years, 22 (53.65%) were aged 35 to 44 years. The mean age was  $21.35 \pm 2.40$  years. The gestational age was 20 to 24 weeks in 07 (17.77%) women, the gestational age was 20 to 24 weeks in 07 (17.77%) women, 25 to 30 weeks in 05 (12.19%) women, 31 to 35 weeks in 08 (19.51%) women, and above 35 weeks in 02 (04.87%) women. 06 (14.63%) women were primi gravida, 04 (09.75%) were gravida-1, 04 (09.75%) were gravida-2, 17 (41.46%) were gravida-3, and 03 were gravida -3 and 02 (04.87%) were gravida-4. 10 (24.39%) women were primi Para, 09 (21.95%) women were para-1, 09 (21.95%) women were para-1, 06 (14.63%) women were para-2, 04 (09.75%) women were para-3, and 02 (04.87%) women were para-4. (Table 1) Vaginal delivery was conducted in 19 (46.34%) pregnant women who developed ICH and 22 (53.65%) women were undertaken caesarian operation to deliver the fetus.

There were 09 (21.95%) women who were during the post-partum period. Among them 01 was admitted in 1st to 2nd week after delivery, 05 women were admitted during the 2rd to 4th week after delivery and 03 women were admitted during 5th and 7th week after delivery. (Table 1) There

was no significant relationship between ages, gestational age, status of their gravida, and status of

their Para, mode of delivery or admission week after delivery. ( $P > 0.05$ )

**Table 1: Demographic details of the subjects (n-41)**

Variable	Number	Percentage	P value
<b>Age</b>			0.145
18 to 24	05	12.19	
25 to 34	14	34.14	
35 to 44	22	53.65	
<b>Gestational Age</b>			0.211
20 to 24 weeks	07	17.77	
25 to 30 weeks	05	12.19	
31 to 35 weeks	08	19.51	
35 and above	02	04.87	
<b>Gravid status</b>			0.314
0	06	14.63	
1	04	09.75	
2	17	41.46	
3	03	07.31	
4	02	04.87	
<b>Para status</b>			0.420
0	10	24.39	
1	09	21.95	
2	06	14.63	
3	04	09.75	
4	02	04.87	
<b>Mode of Delivery</b>			0.110
Vaginal	19	46.34	
Cesarean	22	53.65	
<b>Post-partum admissions</b>			0.174
01 to 02 weeks	01	02.43	
02 to 04 weeks	05	12.19	
05 to 07 weeks	03	07.31	

Subarachnoid hemorrhage (SAH) was the most common spontaneous ICH in the pregnant women in this study; 16 (39.02%) women developed ICH due to SAH. Intra-parenchymal Hemorrhage (IPH) was noted in 12 (29.26%), Sub Dural hemorrhage was noted in 09 (21.95%) of the total women. Extra Dural hemorrhage was noted in 04 (09.75%) women. (Table 2)

**Table 2: Types of Strokes encountered in the study (n-41)**

Variable	Number	Percentage	P value
SAH	16	39.02	
IPH	12	29.26	
SDH	09	21.95	
Extradural hemorrhages	04	09.75	

Coil or clipping was used to treat surgically in 06 (14.63%) pregnant women, Endovascular embolization was used in 03 (07.31%) women, Burr hole evacuation of blood was done in 13 (31.70%) women, endoscopic assisted evacuation was done in 08 (19.51%) women and open craniotomy was done in 04 (09.75%) women in this study. (Table 3)

**Table 3: Surgical methods used in the study (n-41)**

Variable	Number	Percentage	P value
Coil or clipping	06	14.63	
Endovascular Embolization	03	07.31	
Burr hole evacuation	13	31.70	
Endoscope assisted evacuation	08	19.51	
Open craniotomy	04	09.75	

Complications noted during the management of Spontaneous cerebral strokes in pregnant women were found to be pneumonia in 07 (17.07%), infection at surgical site in 04 (09.75%), seizures in 11 (26.82%), loss of fetus in 04 (09.75%) persistent hypertension in 06 (14.63%) and difficulty in decanulation of tracheostomy in 01 (02.43%). (Table 4)

**Table 4: Showing the complications in the study (n-41)**

Complications	Number	Percentage	P value
Pneumonia	07	17.07	
Infection of surgical site	04	09.75	
Seizures	11	26.82	
Loss of fetus	04	09.75	
Persistent hypertension	06	14.63	
Difficult decanulation of Tracheostomy	01	02.43	

Total recovery from the strokes was observed in 19 (46.34%) women, termination of pregnancy was undertaken in 15 (36.58%) of women, persistent ICH in 03 (07.31%) women, recurrence in 01 (02.43%), death in 04 (09.75%) and seizures persisting in 11 (26.82%) women. (Table 5)

**Table 5: Final outcome and follow up of subjects (n-41)**

Variable	Number	Percentage	P value
Total recovery	19	46.34	
Termination of pregnancy	15	36.58	
Persisting ICH	03	07.31	
Recurrence	01	02.43	
Death	04	09.75	
Seizures	11	26.82	

## Discussion

Present study was conducted at a tertiary care Hospital with OBG and Neurosurgical specialists available to elucidate pregnancy-associated stroke using the Inpatient Sample by estimating the changes in overall pregnancy associated stroke as well as stroke with and without hypertensive disorders of pregnancy; identifying the stroke risk factors play a role in these hypertensive disorders of pregnancy and stroke.

In India the prevalence of spontaneous strokes was declining but there was a spurt in the cases post Covid-19 pandemic; [11] the prevalence increased by 05.4% among the elder adults between 202–2023. [12] Prevalence of strokes with hypertension also increased in addition to prevalence of hypertension alone also increased disproportionately. [13] The rate of hypertensive disorders of pregnancy also increased during the study period. [14] The world wide prevalence of stroke in pregnancy is 04 to 11%. [15]

In this study the prevalence was 03.55%; 05 (12.19%) were aged 18 to 24 years, 014 (34.14%) were aged 25 to 34 years, 22 (53.65%) were aged 35 to 44 years. The mean age was 21.35±2.40 years. Stroke in a pregnant woman demands quick decisions and early treatment in a specialized medical unit with definite protocols to save the child and the mother. The morbidity and mortality will be reduced. In this study, Subarachnoid hemorrhage (SAH) was the most common spontaneous ICH in the pregnant women in this study; 16 (39.02%) women developed ICH due to SAH. Intra-parenchymal Hemorrhage (IPH) was noted in 12 (29.26%), Sub Dural hemorrhage was noted in 09 (21.95%) of the total women. Extra Dural hemorrhage was noted in 04 (09.75%)

women. (Table 2) Leys D, Lucas L et al [15] concluded that stroke was secondary to intra-parenchymal rupture of an intracranial vessel resulting in hematoma causing arterial ischemia or compressive failure of blood supply to the surrounding nerves. [15]

The other causes are usually subarachnoid hemorrhage or cerebral subarachnoid hemorrhage. [16] Though it is difficult to connect the effects of pregnancy and postpartum to a stroke episode, it seems that the post-partum and pregnancy are risk periods. According to Kittner et al the ischemic and hemorrhagic strokes are much commoner during post-partum period rather than during the pregnancy. [17] Hypertension was commonly identified even in younger pregnant women both during

The protocol of management of the stroke patients is similar to the stroke patients without pregnancy particularly regarding symptomatic and preventive measures. [18] Importance was given to control the blood pressure and investigations to identify the site of bleed and to rule out causative factors. [19].

In this study coil or clipping was used to treat surgically in 06 (14.63%) pregnant women, Endovascular embolization was used in 03 (07.31%) women, Burr hole evacuation of blood was done in 13 (31.70%) women, endoscopic assisted evacuation was done in 08 (19.51%) women and open craniotomy was done in 04 (09.75%) women in this study. (Table 3) Continuing the pregnancy is difficult in many of the spontaneous stroke situations as it requires admission to ICU or neurosurgical intervention and the pregnancy might have to be terminated. [20]

Total recovery from the strokes was observed in 19 (46.34%) women, termination of pregnancy was undertaken in 15 (36.58%) of women, persistent ICH in 03 (07.31%) women, recurrence in 01 (02.43%), death in 04 (09.75%) and seizures persisting in 11 (26.82%) women. (Table 5)

**Limitations:** It was observed that the codes for stroke and hypertensive disorders of pregnancy generally have high specificity but more limited sensitivity. Hence the estimates of relative risk in the analysis of risk factors and the association with adverse outcomes should be relatively unbiased.

### Conclusions

Spontaneous hemorrhagic stroke is a therapeutic emergency. During pregnancy the maternal and fetal prognosis are involved. The multidisciplinary management allows one to find the best compromise between the requirements imposed by the state of the mother and those related to the presence of fetus.

### References

1. Grear KE, Bushnell CD. Stroke and pregnancy: clinical presentation, evaluation, treatment, and epidemiology. *Clin Obstet Gynecol* 2013; 56:350–9.
2. Kuklina EV, Tong X, Bansil P, George MG, Callaghan WM. Trends in pregnancy hospitalizations that included a stroke in the United States from 1994 to 2007: reasons for concern? *Stroke* 2011; 42:2564–70.
3. Kuklina EV, Ayala C, Callaghan WM. Hypertensive disorders and severe obstetric morbidity in the United States. *Obstet Gynecol* 2009; 113:1299–306.
4. Ananth C, Keyes K, Wapner R. Pre-eclampsia rates in the United States, 1980-2010: age-period-cohort analysis. *BMJ* 2013; 347:f6564.
5. Kuklina EV, Callaghan WM. Cardiomyopathy and other myocardial disorders among hospitalizations for pregnancy in the United States: 2004-2006. *Obstet Gynecol* 2010; 115:93–100.
6. Kuklina EV, Whiteman MK, Hillis SD, Jamieson DJ, Meikle SF, Posner SF, et al.. An enhanced method for identifying obstetric deliveries: Implications for estimating maternal morbidity. *Matern Child Health J* 2008; 12:469–77.
7. Joint Commission on Disease-Specific Care Certification Program. Stroke performance measurement implementation guide, 2nd edition, version 2.a. 2008. Available at: [http://www.jointcommission.org/assets/1/18/stroke\\_pm\\_implementation\\_guide\\_ver\\_2a.pdf](http://www.jointcommission.org/assets/1/18/stroke_pm_implementation_guide_ver_2a.pdf). Retrieved September 2014.
8. HCUP Nationwide Inpatient Sample (NIS). Healthcare cost and utilization project (HCUP). Rockville (MD): Agency for Healthcare Research and Quality; 1994–2011.
9. SUDAAN Example Manual. Research Triangle Park (NC): Research Triangle Institute; 2012.
10. Houchens R, Elixhauser A. Using the HCUP nationwide inpatient sample to estimate trends (updated for 1988–2004). Vol 5. Rockville (MD): Agency for Healthcare Research and Quality; 2006. p. 1–53.
11. Kuruvilla A, Bhattacharya P, Rajamani K, Chaturvedi S. Factors associated with misdiagnosis of acute stroke in young adults. *J Stroke Cerebrovasc Dis* 2011; 20:523–7.
12. Russo CA, Andrews RM. Statistical briefs No. 51: hospital stays for stroke and other cerebrovascular diseases, 2005. Rockville (MD): Agency for Health Care Policy and Research; 2008.
13. Flegal KM, Carroll MD, Kit BK, Ogden CL. Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. *JAMA* 2012; 307:491–7.
14. Redman CW, Sargent IL. Latest advances in understanding preeclampsia. *Science* 2005; 308:1592–4.
15. O'Donnell MJ, Xavier D, Liu L, Zhang H, Chin SL, Rao-Melacini P, et al.. Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): a case-control study. *Lancet* 2010; 376:112–23.
16. Leys D, Lucas L. Pathologie vasculaire cérébrale de la grossesse et du post-partum. *EMC neurologie*. 2006; 6(17):3–8.
17. Dias M, Sekhar L. Intracranial hemorrhage from aneurysm and art ériovenous malformations during pregnancy and the puerperium. *Neurosurgery*. 1990 Dec; 27(6):855–65.
18. Steven J. Kittner, Barney J. Stern, Barbara R. Feese, J. Richard Hebel, David A. Pregnancy and the Risk of Stroke. *N Engl J Med* 1996; 335:768-774.
19. Krishnamurthi RV, Moran AE, Forouzanfar MH, et al. The global burden of hemorrhagic stroke. *Global Heart*. 2014; 9(1):101–6.
20. Sacco S, Marini C, Toni D, Olivieri L, Carolei A. Incidence and 10-year survival of intracerebral hemorrhage in a population-based registry. *Stroke*. 2009; 40(2):394–9.
21. Hemphill JC, Greenberg SM, Anderson CS, et al. Guidelines for the Management of Spontaneous Intracerebral Hemorrhage: A Guideline for Healthcare Professionals from the American Heart Association/American Stroke Association. *Stroke*. 2015; 46(7):2032–60.