Autopsy study of maternal death in a tertiary care centre

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Abstract

Aims: The main objective is to study the gross pathology and microscopy of all organs in cases of maternal death, establish clinico-pathological correlation, to ascertain the exact cause of death and classify them into direct or indirect causes.
Settings and Design: Cross sectional study of all medical autopsies
Materials and Methods: A cross sectional study of all medical autopsies performed on deaths related to pregnancy at our tertiary care hospital over a period of four years. A total of 100 cases were studied. Maternal mortality autopsies where medico legal implications were involved or unnatural deaths not related to pregnancy were excluded from the study.
Statistical Analysis used: Nil
Results: The maximum no. of maternal deaths occurred in the age group 20-24 years (45%) followed by 30-34 years (19%). 62% of patients in our study were multigravidae. Majority of maternal deaths were seen in the postpartum period (75%). In the antepartum period maximum number of maternal deaths occurred in 3rd trimester (14%) Our study revealed majority of maternal deaths were due to indirect causes (76%), Pregnancy induced hypertension was the most common direct cause of death (9%). The majority of cases were due to infectious aetiology (45%), while the other indirect causes were sepsis (14%), coagulopathy (8%) and hemodynamic (8%).
Conclusion: The higher MMR in our study could be attributed to the fact that ours being a tertiary and referral care hospital, where patients are referred late and most of them are complicated cases and in serious condition at the time of admission. The low socioeconomic status of the patients, delay in referral and non-utilisation of the available antenatal care could be the major contributing factors.
Our study revealed majority of maternal deaths were due to indirect causes especially respiratory infections and hepatitis Increased incidence of indirect causes reflect the present health care system. So adequate prenatal testing for these causes (infections), improving the nutritional status, sanitation can help in lowering the maternal mortality rate.

Keywords: Autopsy, Maternal death.

Introduction

Maternal death has serious implications on the family and the society.[1] Approximately 529,000 women die from pregnancy-related causes annually and almost all (99%) of these maternal deaths occur in developing nation. Every minute a woman dies during labour.[2] Maternal Mortality Rate (MMR) is a very sensitive index that reflects the quality of reproductive care provided to the pregnant women.[1] Maternal mortality rate is defined internationally, as the maternal death rate per 1, 00,000 live births.[3] The autopsy studies would provide information on preventable causes of death, consequently leading to strategies for treatment and prevention of maternal morbidity.[3] Hence this study was undertaken to evaluate the MMR in our tertiary care hospital and analyse the various causes of death and to study pathology in various organs.

Materials and Methods

We did a cross sectional study of all Medical autopsies performed on deaths related to pregnancy at Lokmanya Tilak Municipal Medical College Sion, Mumbai, tertiary care hospital over a period of four years from April 2011 to March 2015. The sample size in the above period was 100 cases. Maternal mortality autopsies where medicolegal implications were involved or unnatural deaths not related to pregnancy were excluded from the study. All organs and tissues collected at autopsy and their gross pathology and microscopy was studied using H & E Stain and special stains whenever required. Clinical details were collected from Autopsy records and indoor papers.

Parameters studied were Gross pathology and Microscopy of all organs ascertaining the cause of death and Correlation with the clinical presentation and various haematological, biochemical and radiological investigations. In autopsies significant organ systems which were examined grossly in detail.

Results

Our study was carried out in a tertiary care hospital in the Department of Pathology over a period of four years from April 2011 to march 2015. Over these four years a total of 1714 autopsies were performed by our department, out of these 100 were maternal deaths and included in this study. Maternal mortality autopsies constituted 5.83% of the total autopsies.

There were 44604 live births and 332 maternal deaths over the period from April 2011 to March 2015. Thus the calculated maternal mortality rate in our present study in the above mentioned duration was 744 per 1 lakh live births.

The maximum no. of maternal deaths occurred in the age group 20-24 years (45%). The youngest maternal death occurred at the age of 18 years while the eldest death occurred in the age of 39 years. 62% of maternal deaths occurred in multigravidae. majority of maternal deaths were seen in the postpartum period (75%). In the antepartum period maximum number of maternal deaths occurred in 3rd trimester (14%), followed by 2nd trimester (7%) and 1st trimester (4%) 76% of patients died due to indirect causes and only 24% patients died due to direct causes.

Table 1. Distribution of maternal deaths due to direct causes (24 cases)

Direct cause	No. of cases
Pregnancy induced hypertension	09
Acute fatty liver of pregnancy	03
Abruptio placenta	03
Disseminated intravascular coagulation following IUFD	02
Ectopic pregnancy	02
Placenta praevia	02
Rupture of uterus	01
Vesicular mole	01
Puerperal sepsis	01
Total	24

Pregnancy induced Hypertension: We had nine cases of pregnancy induced hypertension. At autopsy the liver on cut surface showed extensive areas of necrosis. (Fig. 1)

Fig. 1

Acute Fatty Liver of Pregnancy: At autopsy fatty liver was seen. On histology all the three cases showed micro vesicular fatty changes in liver with chronic inflammatory infiltrate in the periportal area and hepatic lobule with Kupffer cell hyperplasia. (Fig. 2) The cause of death was ascertained as hepatocellular failure in all the cases.

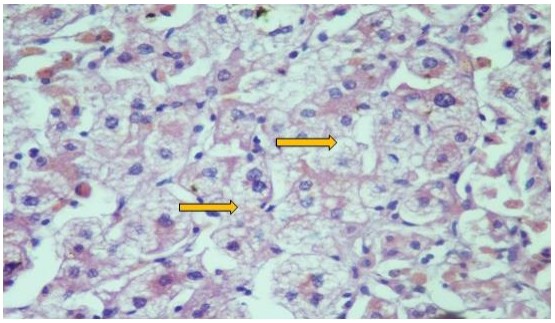

Fig. 2

Abruptio Placenta: There were three cases of abruptio placenta presented in the post-partum period and all were multigravidae.

Features of acute tubular necrosis were revealed on microscopy.

Placenta Praevia: At autopsy all organs were pale, liver showed macro vesicular fatty change and centrizonal necrosis. The cause of death in both the cases was hypovolemic shock following excessive bleeding in a case of placenta praevia.

Disseminated Intravascular Coagulation following Intrauterine Foetal Death: There were two multigravidae who presented in the 3rd trimester with intrauterine foetal death and pain in abdomen. At autopsy there were petechiae noted in the internal organs in the gastric mucosa, intestinal mucosa and capsule of liver. Histology revealed presence of fibrin thrombi in the renal and pulmonary microvasculature (Fig. 3).

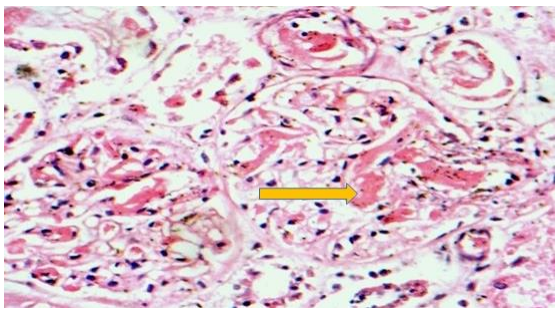

Fig. 3

Table 2. Distribution of maternal deaths due to indirect causes

Distribution of maternal deaths due to indirect causes	No. of cases
Infections	45
Sepsis	14
Coagulopathy	09
Hemodynamic causes	08
Total	76

Cerebral Infarct: Majority of the cases in this category were due were due to Dural venous thrombosis. All the four cases presented in postpartum period and were

multigravidae. At autopsy the superior sagittal sinuses showed beaded appearance and on cut opening showed thrombus. Two cases had associated cerebral infarcts and pin point haemorrhages in the right and left parietal lobes respectively (Fig. 4) one postpartum multigravida female died due to systemic thromboembolism embolism with coexisting pulmonary thromboembolism (Fig. 5) along with pulmonary infarct with splenic artery thrombosis with global splenic infarct.

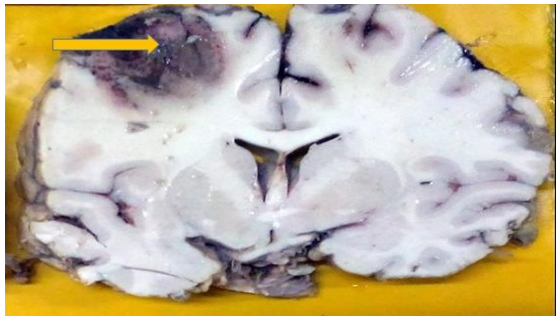

Fig. 4

Fig. 5

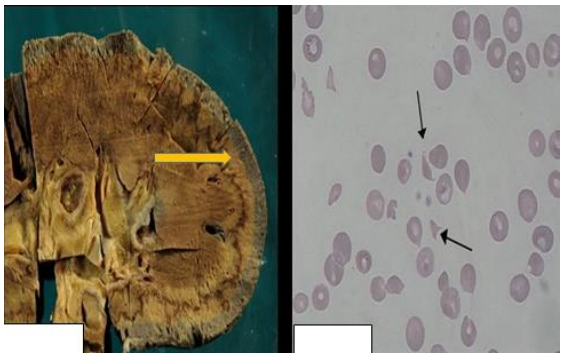

Fig. 6

Discussion

Our study was carried out in a tertiary care hospital in the Department of Pathology over a period of four years from April 2011 to march 2015. Over these four years a total of 1714 autopsies were performed by our department, Out of these 100 were maternal deaths and included in this study. Maternal mortality autopsies thus constituted 5.83% of the total autopsies.

The following table depicts the maternal mortality rate of our study in comparison to various national and international studies in tertiary care based institutes in both autopsy as well as clinical studies-

Table 3: Incidence of MMR

Authors	Maternal mortality rate per 1 lakh live birth
Panchabhai TS et al [45]	827
Jashnani KD et al [46]	1133
Nishu P et al [47]*	270.33
Zaman S et al [48]*	709.35
Walraven G et al [49]*	424
Present study	744

*Clinical studies

We observed that age of the patients in our present study ranged from 18 years to 39 years. Majority of the cases were in age group of 20-24 years (45%). Bardale RV et al[50] found the maximum number of maternal deaths in the age group 21-25 years (52.38%) similar to our study.

Influence of gravida on maternal mortality –

In our present study we found that the majority of maternal deaths occurred multigravidae (62%) which was similar to the study by Panchabhai TS et al[45] (62.45%). While in other studies by Nishu P et al[47] (49.48%), Puri A et al[51] (51.53%) and Anandalakshmy PN et al[52] (52.38%), there was an almost equal distribution amongst primigravidae and multigravidae.

Influence of gestational age on maternal mortality-

In our present study we observed that majority of maternal deaths were seen in the postpartum period (75%). In the antepartum period maximum number of maternal deaths occurred in 3rd trimester (14%), followed by 2nd trimester (7=%) and 1st trimester (4%). In a study by Jashnani KD et al[46] postpartum deaths constituted 70% of maternal deaths and was comparable to our present study.[53]

The following table depicts the comparison of direct and indirect causes of our present study with various national and international both autopsy as well as clinical studies-

Table 4: Distribution of direct and indirect causes

Author	Direct causes	Indirect causes
Jashnani K D et al [46], n =89	38.2%	61.2%
Panchabhai TS et al [45], n = 277	48.3%	51.7%
Fubara DS et al [54]*, n = 60	35%	65%
Puri A et al [51]*, n =72	55.39%	44.61%
Present study, n = 100	24%	76%

*clinical studies

The following table shows the various direct causes of maternal death in our present study and comparison with other studies

Table 5: Distribution of maternal deaths due to direct causes

Direct causes	Jashnani K D et al [46], n =89	Panchabhai TS et al [45], n = 277	Verma A et al [55]* n = 65	Surat Z et al [48]* n= 73	Present study n= 100
PIH	13.4%	14.44%	10.8%	28.7%	9%
AFLP	3.3%	2.53%			3%
Abruptio placenta		1.81%	10.2%	4%	3%
DIC f/g IUFD		2.17%			2%
Placenta praevia		0.71%	10.3%	3%	2%
Ectopic	1.1%		2.7%		2%
Rupture uterus	1.1%		4.1%		1%
Vesicular mole					1%
Puerperal sepsis	11.2%	5.78%	10.8%	9.5%	1%

*clinical studies

In the present study it was found that 9% of maternal deaths were due to pregnancy induced hypertension. Panchabhai TS et al[45] observed major cause of death in pregnancy induced hypertension to be DIC following sepsis. There incidence of cerebral edema and cerebral bleed was lower than us. Sawhney H et al[56] analysed 69 maternal deaths due to eclampsia and found stroke (30.4%), cerebral bleed (31.8%), acute renal failure (34.8%) were the most common causes of death.

The following table depicts the distribution of carious indirect causes of death by various studies and comparison with our present study.

Table 6: Indirect causes of death in pregnancy

Indirect causes	Jashnani K D et al [46], n =89	Panchabhai TS et al [45], n = 277	Verma A et al [56]* n = 65	Surat Z et al [48]* n= 73	Present study n=100
Acute hepatitis	41.5%	6.5%	4.6%		20%
Tuberculosis	2.2%	7.94%			10%
Pneumonia		0.72%			6%
Malaria	3.3%	2.17%			3%
Others	1.1%	4.07%			3%
Dengue					2%
Leptospirosis		1.08%			1%
Bronchopneumonia f/g sepsis		1.81%			15%
Acute pyelonephritis		2.89%			5%
Dural venous sinus thrombosis	1.1%	1.08%			4%
DIC					2%
Systemic Thromboembolism	1.1%				1%

Thrombotic microangiopathy					1%
Indirect causes	Jashnani K D et al [46], n =89	Panchabhai TS et al [45], n = 277	Verma A et al [56] n = 65	Surat Z et al [48] n= 73	Present study n=100
Dilated cardiomyopathy		0.72%			1%
Sickle cell anaemia	1.6%	1.72%			1%
Rheumatic heart disease	2.2%	7.58%		1.3%	1%

*****clinical studies

In our present study, most common indirect cause of death in pregnancy was acute hepatitis (20%) followed by bronchopneumonia with sepsis (15%). Other indirect causes of death were tuberculosis (10%), pneumonia (6%), acute pyelonephritis (5%), dural venous sinus thrombosis (4%), malaria (3%), dengue (2%), DIC (2%), systemic thromboembolism (1%), thrombotic microangiopathy (1%), dialated cardiomyopathy (1%), sickle cell anemia (1%) and rheumatic heart disease (1%).

Jashnani KD et al[46] observed a high percentage of deaths due to acute hepatitis (41.5%) compared to our study (20%), while Panchabhai TS et al[45] and Verma A et al[56] found a lower incidence of acute hepatitis as an indirect cause of death compared to our study (20%) which was 6.5% and 4.6% respectively.

Panchabhai TS et al[45] found bronchopneumonia followed by sepsis as an indirect cause of death in 1.81% cases which was lower than our present study. (15%) and rheumatic heart disease in 7.58% cases which was higher than our present study (1%).

In our present study fulminant hepatitis was present in (20%) of the cases, other infections were tuberculosis in (10%), pneumonia (6%), malaria (3%), dengue (2%) and leptospirosis (1%) cases. Jashnani KD et al[46] found a higher incidence of maternal deaths due to fulminant hepatitis (41.5%) as compared to our study, while Menendez C et al[60] and Panchabhai TS et al[45] found fulminant hepatitis in 2.2% and 6.5% respectively.

Panchabhai TS et al[45] observed 7.9% maternal deaths due to tuberculosis which was comparable to our study, while Menendez C et al[60] and Jashnani KD et al[46] found lower incidence of 1.4% and 2.2% respectively.

We observed a lower incidence of malaria (3%) in comparision to study done by Menendez C et al[60] (10%). We did not observe any case of HIV in our present study.

Acute Hepatitis: Acute viral hepatitis constituted 20 cases (20%) of maternal deaths in our study, out of which 19 patients died due to hepatic failure and one died due to hepatic encephalopathy. Nagaria T et al[61] studied acute viral hepatitis and observed hepatic encephalopathy as the most common cause of death (60%) followed by DIC (20%).

Khuroo and his colleagues noted a higher incidence of hepatitis E in pregnancy, eight times than in non-pregnant women, hepatitis was more than twice as common in 2nd trimester and 3rd trimester affected 22% of pregnant women.[62]

Anaemia: We had five maternal deaths (5%) due to severe anaemia with congestive cardiac failure. It has been estimated that 20% of maternal deaths in Africa can be attributed to anaemia.

Pituitary: We studied pituitary in all the cases and found pituitary necrosis in two cases (2%), and tubercular granuloma in one case (1%), while Jashnani KD et al[46] observed pituitary necrosis in 2 cases (2.24%) out of 89 cases. Sheehan's syndrome also known as postpartum anterior pituitary necrosis is caused due to ischemic necrosis due to blood loss and hypovolemic shock after child birth. Clinically the patient presents with postpartum haemorrhage, shock, headache, and diplopia.

Conclusion

The higher MMR in our study could be attributed to the fact that ours being a tertiary and referral care hospital, where patients are referred late and most of them are complicated cases and in serious condition at the time of admission. The low socioeconomic status of the patients, delay in referral and non-utilisation of the available antenatal care could be the major contributing factors.

Our study revealed majority of maternal deaths were due to indirect causes especially respiratory infections and hepatitis Increased incidence of indirect causes reflect the present health care system. So adequate prenatal testing for these causes (infections), improving the nutritional status, sanitation can help in lowering the maternal mortality rate.

References

1. Bhushan H, Bhardwaj A. Task shifting: A key strategy in the multiprolonged approach to reduce maternal mortality in India. *Int J Gynaecol Obstet.* 2015;131(1):67-70.
2. Nawal MN. An Introduction to Maternal Mortality. Women's Health in the Developing World. *Rev Obstet Gynecol.* 2008;1(2):77-81.
3. Lucas S. The Maternal death autopsy. In: Pignatelli M, Gallagher P, editors. Recent advances in histopathology. 23rd ed. London: JP Medical Publishers; 2014.p.17-30.
4. Wilmoth JR, Oestergaard MA, Say L, Mathers CD, Zureich S, Inoue MA. New Method for Deriving Global Estimates of Maternal Mortality. Statistics, Politics and Policy. 2012;3(2): 1–31.
5. Kumar A. Monument of Love or Symbol of Maternal Death: The Story Behind the Taj Mahal. Case Reports Women's Health. 2014;1(1):4-7.

6. Khan KS, Wojdyla D, Say L, Gülmezoglu AM, Van Look PF. WHO analysis of causes of maternal death: a systematic review. *Lancet.* 2006;367(9516):1066-74.
7. Hill K. Expert Panel on Capturing Maternal Mortality in the 2010 Census Round. Measuring maternal mortality. Lancet. 2006; 368(9553):2121.
8. Stanton C. Every death counts: measurement of maternal mortality via a census. *Bull World Health Organ.* 2001;79(7):657-64.
9. Van D, Broek NR, Falconer AD. Maternal mortality and Millennium Development Goal 5. *British Medical Bulletin.* 2000;99(1):25–38.
10. Zureick S. Understanding global trends in maternal mortality. International Perspectives on Sexual and Reproductive Health. 2000;39(1):32–41.
11. Hill K, Thomas K, Abouzahr C, Walker N, Say L, Inoue M, Suzuki E. Maternal Mortality Working Group - Estimates of maternal mortality worldwide between 1990 and 2005: an assessment of available data. *Lancet.* 2007;370(9595):1311-9.
12. Bhatt RV, Hazra MN. Maternal mortality in India. *J Indian Med Assoc.* 2001;99(3):148-50.
13. Vora KS. Maternal health situation in India: a case study. *J Health Popul Nutr.* 2009;27(2):184-201.
14. Cunningham FG. Obstetrical complications- Pregnancy hypertension. In: Cunningham FG et al, editors. Williams's obstetrics. 23rd Ed. New York: McGraw-Hill companies; 2010.p.706-756.
15. Kamran B, Jacqueline L. Wolf. Liver pathology in pregnancy. In: OdzeRD, Goldblum JR, editors. Surgical Pathology of the GI Tract, Liver, Biliary Tract, and Pancreas. 2nd ed. Philadelphia: Saunders Elsevier; 2009.p.1231-1244
16. Wang YQ, Wang J, Ye RH, Zhao YY. Investigation of diagnosis and treatment of haemolysis-elevated liver enzymes-low platelet counts (HELLP) syndrome: clinical analysis of 59 cases. *Chinese Medical Journal.* 2010;123(10):1273-7.
17. Rahman TM, Wendon J. Severe hepatic dysfunction in pregnancy. *QJM.* 2002;95(6):343-57.
18. Maier JT, Schalinski E, Haberlein C, Gottschalk U, Hellmeyer L. Acute Fatty Liver of Pregnancy and its Differentiation from Other Liver Diseases in Pregnancy. *Geburtshilfe* Frauenheilkd. 2015;75(8):844-847.
19. Woiski MD. Guideline-based development of quality indicators for prevention and management of postpartum haemorrhage. *Acta Obstet Gynecol Scand.* 2015;94(10):1118-27.
20. Macheku GS, Philemon RN, Oneko O, Mlay PS, Masenga G, Obure J, et al. Frequency, risk factors and feto-maternal outcomes of abruptio placentae in Northern Tanzania: a registry-based retrospective cohort study. *BMC Pregnancy Childbirth.* 2015;15(1):242.
21. Usta IM, Hobeika EM, Musa AA, Gabriel GE, Nassar AH. Placenta previa-accreta: Risk factors and complications. *Am J Obstet Gynecol.* 2005;193(3):1045-9.
22. Miller DA, Chollet JA, Goodwin TM. Clinical risk factors for placenta previa–placenta accreta. *American Journal of Obstetrics and Gynecology.* 1997;177(1):210–214.
23. Tapson VF. Acute pulmonary embolism. *N Engl J Med.* 2008;358(10):1037-52.
24. Liu S, Rouleau J, Joseph KS, Sauve R, Liston RM, Young D, Kramer MS. Epidemiology of pregnancy-associated venous thromboembolism: a population-based study in Canada. *Journal of Obstetrics and Gynaecology Canada.* 2009;31(7):611–20.
25. Balinger KJ, Chu Lam MT, Hon HH, Stawicki SP, Anasti JN. Amniotic fluid Embolism: despite progress, challenges remain. *Curr Opin Obstet Gynecol.* 2015;27(6):398-405.
26. Pacheco LD, Saade GR, Hankins GDV. Severe sepsis during pregnancy. *Journal of Clinical Obstetrics and Gynecology.* 2014;57(4):827–34.
27. Radhakrishnan G. Maternal infections-viral and protozoal infections. In: Renu Misra, editor. Ian Donald's Practical obstetric Problems. 6th Ed. New Delhi: B I Publications Pvt Ltd; 2014.p.212-222.
28. Lucas SB. Viral and infectious diseases and HIV-related liver disease. In: Macsween RMN, Burt AD, Portmann BC, Ishk KG, Scheurer PJ, Portmann BC, Anthony PP editors. Pathology of the Liver.4th ed. London; Churchill Livingstone: 2002. P.363-414.
29. Desmet JR. Liver Nonneoplastic diseases, Tumor and Tumor like Conditions. In: Rosai J, editor. Surgical Pathology. 1. 10th ed. Mosby; Elsevier: 2012. p. 860-73.
30. Kumar A, Beniwal M, Kar P, Sharma JB, Murthy NS. Hepatitis E in pregnancy. *Int J Gynaecol Obstet.* 2004;85(3):240-4.
31. Aggarwal R, Krawczynski K. Hepatitis E: an overview and recent advances in clinical and laboratory research. *J Gastroenterol Hepatol.* 2000;15(1):9-20.
32. Michielsen PP, Van Damme P. Viral hepatitis and pregnancy. *Acta Gastroenterol Belg.* 1999;62(1):21-9.
33. Jaiswal SP, Jain AK, Naik G, Soni N, Chitnis DS. Viral hepatitis during Pregnancy. *Int J Gynaecol Obstet.* 2001;72(2):103-8.
34. Borgia G, Carleo MA, Gaeta GB, Gentile I. Hepatitis B in pregnancy. *World J Gastroenterol.* 2012;18(34):4677-83.
35. Bhatla N, Lal S, Behera G, Kriplani A, Mittal S, Agarwal N, Talwar KK. Cardiac disease in pregnancy. *Int J Gynaecol Obstet.* 2003;82(2):153-9.
36. Oslen EGJ, Fox H. Pathology of the cardiovascular system in pregnancy. In: Fox H, Wells M, editors. Haines and Taylor Obstetrical and gynaecological pathology. Vol 2. 4th edn. New York: Churchill Livingstone; 1995.p.1769-1770.
37. Bishara H, Goldstein N, Hakim M, Vinitsky O, Shechter AD, Weiler RD. Tuberculosis during Pregnancy in Northern Israel, 2002-2012: Epidemiology and Clinical Practices. *Isr Med Assoc J.* 2015;17(6):346-50.
38. Rogerson SJ, Mwapasa V, Meshnick SR. Malaria in pregnancy: Linking immunity and pathogenesis to prevention. *American Journal of Tropical Medicine and Hygiene.* 2007;77(6):14–22.
39. Ismail NA, Kampan N, Mahdy ZA, Jamil MA, Razi ZR. Dengue in pregnancy. *Southeast Asian J Trop Med Public Health.* 2006;37(4):681.
40. Carroll ID, Toovey S, Gompel VA. Dengue fever and pregnancy - a review and comment. *Travel Medicine and Infectious Disease.* 2007;5(3):183–8.
41. Rajiv C, Manjuran RJ, Sudhayakumar N, Haneef M. Cardiovascular involvement in leptospirosis. *Indian Heart J.* 1996;48(6):691-4.
42. Dadhwal V, Bahadur A, Deka D. Leptospirosis as a cause of fever in pregnancy. *Int J Gynaecol Obstet.* 2007;99(3):252-3.
43. Hopwood HJ. Pneumonia in Pregnancy. *Obstet Gynecol.* 1965;25(1):875-9.
44. Lurie S, Feinstein M, Mamet Y. Disseminated intravascular coagulopathy in pregnancy: thorough comprehension of etiology and management reduces obstetricians' stress. *Arch Gynecol Obstet.* 2000;263(3):126-30.

45. Panchabhai TS, Patil PD, Shah DR, Joshi AS. An autopsy study of maternal mortality: a tertiary healthcare perspective. *J Postgrad Med.* 2009;55(1):8-11.
46. Jashnani KD, Rupani AB, Wani RJ. Maternal mortality: an autopsy audit. *J Postgrad Med.* 2009;55(1):12-6.
47. Nishu P, Verma A, Verma S. Maternal Mortality: Ten years retrospective study. *J Med Educ Res.* 2010;12(3):3-10.
48. Zaman S, Begum AA. Maternal mortality at a rural medical college of Assam: a retrospective study. *Journal of Obstetrics & Gynaecology Barpeta.* 2014;1(1):46-51.
49. Walraven G, Telfer M, Rowley J, Ronsmans C. Maternal mortality in rural Gambia: Levels, causes and contributing factors. *Bulletin of the World Health Organization.* 2000;78(5):603–613.
50. Bardale RV, Dixit PG. Pregnancy-related deaths: A Three-year retrospective study. *Journal of Indian Academy of Forensic Medicine.* 2010;32(I):15-18.
51. Puri A, Yadav I, Jain N. Maternal Mortality in an Urban Tertiary Care Hospital of North India. *Journal of Obstetrics and Gynaecology of India.* 2011;61(3):280-285.
52. Anandalakshmy PN, Talwar PP, Buckshee K, Hingorani V. Demographic, socioeconomic and medical factors affecting maternal mortality- An Indian experience. *Journal of Family Welfare.* 1993;39(3):1-4.
53. Li XF, Fortney JA, Kotelchuck M, Glover LH. The postpartum period: the key to maternal mortality. *International Journal of Gynecology & Obstetrics.* 1996;54(1):1–10.
54. Fubara DS, Ikimalo J, John CT. Pathology of maternal deaths in Rivers state (a ten year autopsy review) in a referral hospital. *The Nigerian Postgraduate Medical Journal.* 2007;14(3):256–260.
55. Verma A, Minhas S, Sood A. A study on Maternal Mortality. *Journal of Obstetrics and Gynaecology of India*. 2008;58(3):226-229.
56. Sawhney H, Aggarwal N, Biswas R, Vasishta K, Gopalan S. Maternal mortality associated with eclampsia and severe preeclampsia of pregnancy. *J Obstet Gynaecol Res.* 2000; 26(5):351-6.
57. Pereira SP, Donohue, J Wendon J, Williams R. Maternal and perinatal outcome in severe pregnancy-related liver disease. *Journal of International Hepatology.* 1997;26(5):1258–1262.
58. Maier JT, Schalinski E, Häberlein C, Gottschalk U, Hellmeyer L. Acute Fatty Liver of Pregnancy and its Differentiation from Other Liver Diseases in Pregnancy. *Geburtshilfe Frauenheilkd.* 2015;75(8):844-847.
59. Maurya A, Arya S. Study of Antepartum Haemorrhage & Its Maternal & Perinatal Outcome. *International Journal of Scientific and Research Publications.* 2014;4(2):57-64.
60. Menéndez C, Romagosa C, Ismail MR, Carrilho C, Saute F, Osman N, et al. An autopsy study of maternal mortality in Mozambique: the contribution of infectious Diseases. *PLoS Med.* 2008;5(2):44.
61. Nagaria T, Agarwal S. Fetomaternal outcome in jaundice during pregnancy. *J Obstet Gynecol India*. 2005;55(5):424-427.
62. Khuroo MS, Teli MR, Skidmore S, Sofi MA, Khuroo MI. Incidence and severity of viral hepatitis in pregnancy. *The American Journal of Medicine.* 1981;70(2):252–255.

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