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## Original Research Article

## Placental morphology in Covid-19: A study in tertiary hospital in Telangana

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## ABSTRACT

**Background:** Due to emerging new variants of Corona virus, study of placental histopathological changes helps in understanding its tissue tropism and effects of the virus of maternal and foetal morbidities.**Study Design:** Prospective Observational Study.**Objectives:** To evaluate and describe histopathologic findings in the placentas of women affected with COVID19.**Materials and Methods:** A total of 16 placentas from pregnant women who were infected with COVID-19 in any gestational age and delivering between March 2020 and February 2022 were examined and compared with normal third trimester placentas received in the same time period.**Results:** Among the 16 placentas examined, most significant change as a sign of maternal malperfusion is increased intervillous fibrin deposition, which is seen in 81.25% cases, followed by infarction, calcification, increased syncytial knots, haemorrhage, calcification, vascular congestion and fibrin thrombi. Most significant foetal malperfusion sign is Chorangiomas which is seen in 37.5% cases, followed by thrombi in umbilical vessels. Also, 25% of the placentas examined showed Villitis, 18.75% showed Deciduitis, 6.25% showed Chorioamnionitis and 6.25% showed vasculitis.**Conclusions:** COVID-19 placentas show increased prevalence of decidual arteriopathy and features of foeto-maternal vascular malperfusion which can be related to the consequences in foetus like Preterm delivery, IUGR and respiratory distress.This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.For reprints contact: [reprint@ipinnovative.com](mailto:reprint@ipinnovative.com)

## 1. Introduction

Since the first report of the novel coronavirus 2019 (Covid-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in December 2019, the number of confirmed cases and associated mortality and morbidity have increased rapidly.<sup>1,2</sup> Pregnant women are considered a high-risk group because of concerns about the effect of Covid-19 on them during and after pregnancy and on their neonates.<sup>3</sup>

As per WHO Statistics, Globally, about 571 million cases are reported with over 6.38 million deaths of which about 44 million cases and 5.26 lakhs deaths are seen in India till July 2022.<sup>4</sup> Features like increased transmissibility, virulence, ineffective social measures can be concerning factors due to emergence of new strains like Delta and Omicron.<sup>4</sup> During the second wave of Covid-19 infection in 2021, the virus showed genetic changes that caused the virus to escape body's immune system and changes in disease transmissibility and severity are reported.<sup>5</sup>

All variants of Corona virus use the same cellular receptor, carcinoembryonic antigen molecule (CEACAM-1) and the viral spike protein interacts with ACE2 receptors

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and other proteins like CD147, DPP4, GRP78, L-SIGN, and DC-SIGN which help in viral binding to the cell. Serine protease TMPRSS2 and endosomal protease, Furin help in further processing of the viral entry.<sup>6–8</sup> ACE2 is expressed in the placenta<sup>9</sup> and is found in the syncytiotrophoblast, cytotrophoblast, endothelium, and vascular smooth muscle from both primary and secondary villi.<sup>9,10</sup> These proteins are expressed in placental trophoblasts which explains the tissue tropism of the virus to placenta.

Thromboembolic risk is greater during the postpartum period and Covid19 imposes additional risk of hypercoagulation.<sup>11</sup> Placenta was initially hypothesised to be a barrier against SARS- CoV2 infection. Later many studies proved the tissue tropism of the virus and vertical transmission of the virus via placenta. Hence, study of pathological changes in placenta can further help in understanding the tissue specific pathogenesis of Covid19. Association of severity of malperfusion with foetal outcome and neonatal wellbeing can also be studied as there is scarcity of data and studies done on this subject are low accounting to recent emergence of the pandemic.

## 2. Aim and Objective

To evaluate and describe histopathologic findings in the placentas of women affected with Covid19.

The present study assesses the placental macro and microscopic pathology seen in females who were affected by Covid 19 and treated during antenatal period in a tertiary care centre.

## 3. Materials and Methods

A total of 16 placentas received to the Department of Pathology, with history of mother being infected with Covid19 during the antenatal period were selected and a prospective observational study is done from March 2020 to May 2022. After noting the gross findings, representative sections were taken from placental membranes, parenchyma, umbilical cord and after processing, the sections were stained with Haematoxylin and Eosin followed by microscopic examination.

## 4. Observation and Result

Gross examination of the placentas showed increased haemorrhagic foci with no significant lesions or nodularity. Adherent membranes were seen in 6.25% cases and rest of them showed easily peelable membranes (Figures 1 and 2). Average weight of placenta in our study is 475.95 mgs. 37.8% cases have low placental weight.

Microscopic examination showed maternal malperfusion signs which predominantly showed increased intervillous fibrin deposition (81.25% cases) (Figure 7a-b), followed by increased syncytial knots (75%) (Figure 5), infarction (68.75%), calcification (68.75%) (Figure 6), haemorrhage



**Fig. 1:** Maternal surface of placenta



**Fig. 2:** Foetal surface of placenta with umbilical cord

(50%), fibrin thrombi (25%), vascular congestion (18.75%) and most significant foetal malperfusion sign is Chorangiomas (37.5%) (Figures 3 and 4) cases, followed by thrombi and fibrosis in umbilical vessels (18.75%) (Figure 8). Also, 25% of the placentas examined showed Villitis, 18.75% showed Deciduitis, 6.25% showed Chorioamnionitis and 6.25% showed vasculitis. (Table 1).

Out of 16 deliveries, 6.25% had premature rupture of membranes, 87.5% were term deliveries and 13.3% were preterm deliveries. Intra uterine growth retardation was seen in 12.5%, Low birth weight was seen in 18.75% cases, mild to moderate respiratory distress is seen in 37.5% cases.

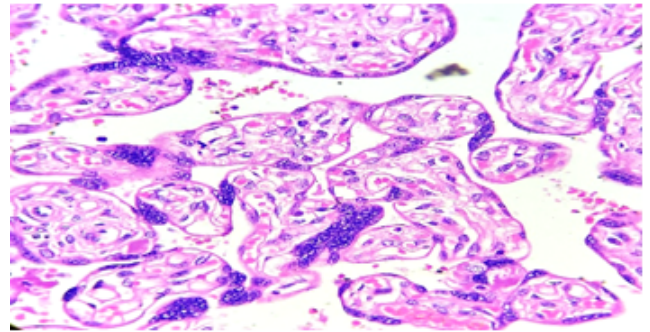
## 5. Discussion

Vivanti A et al. reported a case of transplacental transmission of SARS-CoV-2 from a pregnant woman with COVID-19 during late pregnancy. The authors suggested that SARS-CoV-2 can cause maternal viraemia, placental infection, placental inflammation and neonatal viraemia following placental infection.<sup>12</sup> Researchers in China have documented placental histopathological findings in COVID-

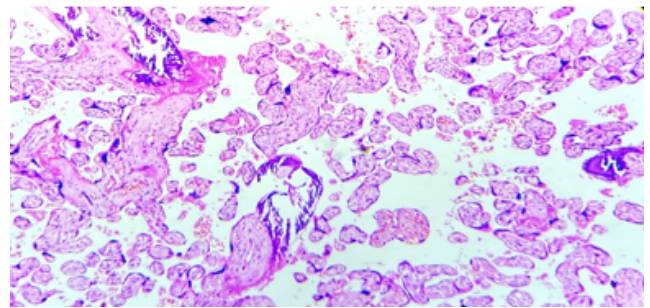


**Table 1:**

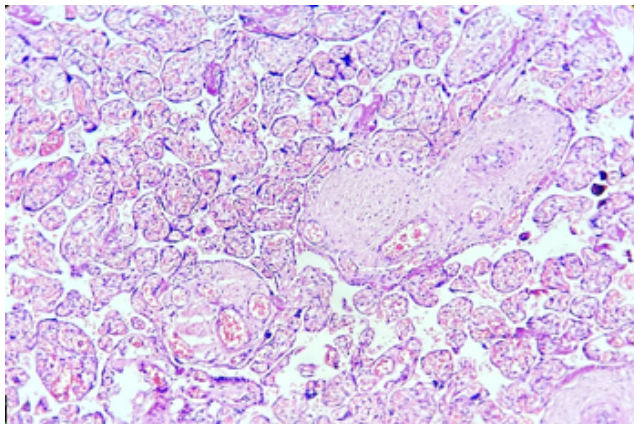
<b>Maternal Malperfusion Signs</b>	<b>Cases</b>	<b>Percentage</b>
Intervillous fibrin	13	81.25
Increased syncytial knots	12	75
Infarction	11	68.75
Calcification	11	68.75
Haemorrhage	8	50
Increased fibrinoid material	7	43.75
Fibrin thrombi	4	25
Vascular congestion	3	18.75
Hyalinisation	2	12.5
<b>Foetal Malperfusion Signs</b>		
Chorangiosis	6	37.5
Thrombi in Umbilical Cord vessels	3	18.75
<b>Signs of Inflammation</b>		
Villitis	4	25
Deciduitis	3	18.75
Chorioamnionitis	1	6.25
Vasculitis	1	6.25



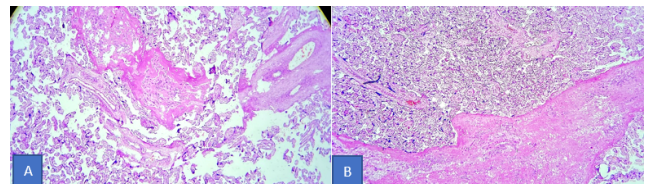
**Fig. 5:** Tenny parker change (40x),



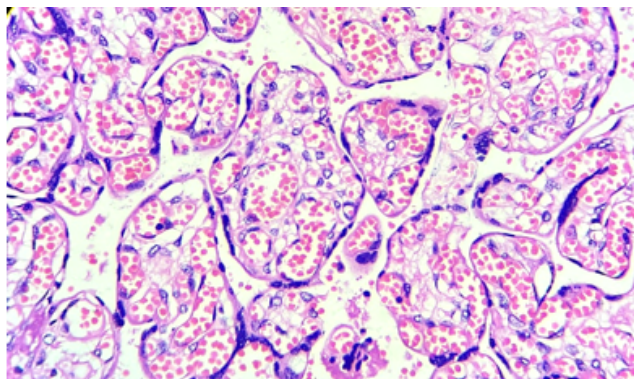
**Fig. 6:** Calcification (10x)



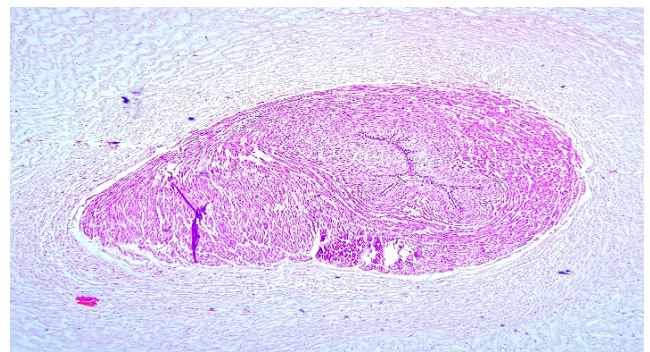
**Fig. 3:** Chorangiosis (10x)



**Fig. 7: a-b:** Fibrin deposition (10x)



**Fig. 4:** Chorangiosis (40x)



**Fig. 8:** Fibrosed umbilical vessel (10x)

19 positive patients to include increased peri-villous fibrin deposition, villous infarcts and chorioangioma.<sup>13</sup>

Several case reports provided evidence that COVID-19 can infect the placenta as confirmed by the presence of SARS-CoV-2 viral RNA and protein in the placenta and evidence of virions found within the syncytiotrophoblast.<sup>14–17</sup> Sisman et al reported a case of preterm baby with placental IHC and ultrastructural findings consistent with SARS CoV2 infection.<sup>18</sup>

Low placental weight observed in few cases is in concordance with a study done by Radan et al who observed low placental weight among 153 Covid pregnancies irrespective of the trimester in which they were affected.<sup>19</sup>

Chorangiosis which is a prominent feature seen in our study represents adaptive response to chronic under perfusion or hypoxia and is known to be associated with decreased maternal oxygen saturation. Diagnosis is based on Altshuler criteria which defines Chorangiomas as presence of more than 10 capillaries in at least 10 terminal villi in more than or equal to 10 non infarcted areas in at least 3 low power fields.<sup>20,21</sup>

Tenney Parker change is also seen in our study which is excessive number of syncytial knots that are seen as a response to hypoxia.<sup>22</sup> True knots are where the syncytiotrophoblast nuclei are sequestered in areas of the villus surface where there is no diffusional exchange. The formation of syncytial knots is increased in placentas from complicated pregnancies. These changes were first described by Tenney and Parker.<sup>23–27</sup>

Another prominent feature is increased in fibrin deposition in placenta. Fibrin deposition is a result of stasis of maternal blood in the subchorionic area of the intervillous space and due to changes in blood flow and eddy currents.<sup>28–30</sup>

Studies have shown that maternal vascular under perfusion is associated with oligohydramnios, foetal growth restriction, preterm birth and stillbirth,<sup>31–33</sup> which is in concordance with the foetal outcomes seen in our study.

## 6. Conclusion

The present study concludes that mothers infected with the COVID19 virus shows many signs of placental malperfusion and inflammation. These can be associated with fetal outcomes like premature rupture of membrane, preterm delivery, low birth weight and intrauterine growth retardation.

## 7. Conflict of Interest

The authors declare no relevant conflicts of interest.

## 8. Source of Funding

None.

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