Lung ultrasound and neonatal COVID-19 pneumonia: A case report.

Daniel Ibarra Ríos (ibarraneonato@gmail.com)
Hospital Infantil de México Federico Gómez https://orcid.org/0000-0001-5381-3142
Dina Villanueva García
Hospital Infantil de México Federico Gómez
Edna Patricia Vázquez Solano
Hospital Infantil de México Federico Gómez
Alfonso de Jesús Martínez García
Instituto Nacional de Perinatología https://orcid.org/0000-0001-7788-9563
María Yolotzin Valdespino-Vázquez
Instituto Nacional de Perinatología
Addy Cecilia Helguera Repetto
Instituto Nacional de Perinatología
Horacio Márquez González
Hospital Infantil de México Federico Gómez https://orcid.org/0000-0001-9041-5813

Case Report

Keywords: COVID- 19, Newborn, Pneumonia, Lung ultrasound

Posted Date: September 16th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-33182/v2

Abstract

Introduction: Severe Novel Coronavirus Disease 2019 (COVID-19) infection in neonates is possible but reports are scarce. Lung ultrasound (LUS) has been reported useful for triaging, diagnosing, and monitoring of patients with COVID-19.

Material and methods: We describe SARS-CoV-2 confirmed infection on a term newborn that developed pneumonia and pulmonary hypertension requiring mechanical ventilation. Ultrasonographic follow up of COVID-19 pneumonia and pulmonary hypertension was carried out. Histopathological and genetic study of the placenta was performed.

Results: A 3,140-g male infant born at 40.3 weeks' gestation developed progressive respiratory distress (pulmonary hypertension) requiring mechanical ventilation. Real time PCR respiratory tract swabs for SARS COV 2 sampled on day 3 were positive for the baby and both parents. Lung ultrasound showed an irregular pleural line (shred sign), multiple confluent B-lines and bilateral ≥ 0.5 cm subpleural consolidations. Improvement of the lung and cardiac conditions were documented by ultrasound. The newborn was supported 6 days with mechanical ventilation, 3 days on CPAP and 3 days on oxygen. No antibiotics were used. The placenta showed histological findings linked to SARS-CoV-2 infection. RT-PCR from placental tissue showed amplification of viral E gene.

Conclusion: Our case represents a severe presentation of COVID-19 pneumonia with pulmonary hypertension requiring mechanical ventilation. LUS showed to be useful for diagnosis and follow up. Transversal infection was possible.

Introduction

COVID-19 is rapidly spreading all around the world. In Mexico at the time 676,212 cases with 70, 229 deaths have been reported (September 9, 2020). Variable clinical and radiographic characteristics of neonates have been described[1]. LUS has been reported useful for triaging, diagnosing, and monitoring of patients with COVID-19[2]. Currently one pediatric and two neonatal case series describing lung ultrasound of infected patients (8 children, 8 newborns) have been reported[3,4,5].

Case Report

A 3,140-g male infant was born at 40.3 weeks' gestation to a 20-year-old gravida woman with history of type 1 diabetes mellitus in control with insulin. The pregnancy had irregular follow up with normal second and third trimester fetal ultrasound. On the day of delivery during labor fetal heart rate late decelerations to 60 beats per min were noted so an emergent caesarean section was planned. During resuscitation no late cord clamping was performed and supplemental oxygen was needed. Apgar scores were 8-9 at 1 and 5 minutes. Oxygen was stopped at minute 16. Silverman Andersen score was one with discrete nasal flaring. No skin to skin contact was performed (mother with general anesthesia). After transition

desaturation occurred so oxygen hood with 30% FiO_2 was applied. Respiratory distress progressed and required high flow nasal cannula on day 2, CPAP on day 3 and was intubated on day 4 secondary to CPAP failure (Silverman Andresen score of 4, $FiO_2 \geq 40\%$, hypoxemia and hypercapnia) with AC(VG) (5.8ml/kg), 30% FiO_2. Real time RT-PCR (RT-PCR) from respiratory tract swabs for SARS COV 2 (sampled on day 3) were positive for the baby and both parents (that reported themselves asymptomatic). Berlin protocol was used and amplified E gene was found in the baby (ct 34) and RdRP/E genes in both parents (ct 34/33 in mother and cts 36/34 in the father), human RNase gene was found in all cases (cts 23/20/21 for baby, mother and father, respectively). On chest radiography important cardiomegaly and bilateral ground-glass opacities were noted. An echocardiogram by Pediatric cardiology was performed finding moderate to severe pulmonary hypertension with right ventricular dilatation. Mild tricuspid and mitral regurgitation were noted. A 6 mm bidirectional patent ductus arteriosus (PDA) was noted with a caution note to evaluate the aortic arch once the PDA closes. Normal head ultrasound was reported. The baby was transferred to a COVID-19 third level referral hospital. One asymptomatic hypoglycemia on admission was managed with an 8 mg/kg/min glucose infusion. Upon arrival (day 5) portable LUS (Konted™, Beijing China, Linear 10.0MHz) showed an irregular pleural line (shred sign), multiple confluent B-lines and bilateral $\geq$ 0.5 cm subpleural consolidations (Figure 1). Admission laboratory exams showed lymphocytic predominance with mild thrombocytopenia with normal coagulation times (Table 1). The infant was kept in an incubator, no antibiotics were used. Blood cultures were negative. Prone positioning and increased PEEP 7-8 allowed FiO_2 to be lowered from 45 to 28%. On day 9 the neonatal intensive care unit ultrasound equipment (*Vivid™ E90,* GE Medical Systems, Milwaukee, WI, USA) was prepared according to the Canadian Association of Emergency Physicians[6] and Pediatric cardiology confirmed a normal aortic arch. Targeted Neonatal Echocardiography (TnE) reported mild to moderate pulmonary hypertension with a 2.3 mm restrictive left to right PDA, biventricular dilatation. Portable LUS without big consolidations detectable, still irregular pleural line and less confluent b lines. Mechanical ventilation occurred for 6 days, then 3 days of CPAP and 3 days of supplemental oxygen. Biventricular dilatation was managed with diuretics. The highest temperature recorded was 37.5 ˚C (axillar). RT PCR was negative at day 14. At day 20 TnE examination reported a 1.9 mm non hemodynamically significant restrictive PDA with improvement of biventricular dilatation and a normal LUS (Figure 2). Baby was discharged at day 26 to an uninfected family member younger than 60 years without co-morbidities. Parents remained asymptomatic and the mothers RT-PCR at day 14 remained positive; at day 28 she was found negative to viral RNA. Pathology Department received the placenta weighing 356 g (small, <p90) with a thin cord and a diameter 0.7cm. Morphologically a phenomenon of chronic fetal vascular under perfusion and placental inflammation was observed (Figure 3). These histological findings have been linked to SARS Cov2 infection. RNA from frozen placenta was processed for SARS-COV2; RT-PCR determination by disruption of the tissue through mechanical lysis with a FastPrep instrument (MP Biomedicals, USA). Real time RT-PCR for SARS-COV2 was carried out and positive amplification of viral E gene was found (ct 30).

Discussion

Case reports or comparative studies on SARS-CoV-2 neonatal infection are limited. Current guidelines represent expert consensus and need to be updated. In our case baby started with respiratory distress shortly after birth and RT PCR was positive on day 3 with both asymptomatic parents being positive as well. Zeng and colleagues reported the outcome of 33 neonates born to mothers with COVID-19 finding despite implementing strict infection control measures 3 neonates (9%) presented with early onset SARS-CoV-2 infection[7]. Transplacental transmission is feasible as virions invading syncytiotrophoblast in placental villi have been documented by electron microscopy[8]. Additionally, Vivanti and colleagues demonstrated a case of transplacental transmission of SARS-CoV-2 from a pregnant woman affected during late pregnancy with her offspring being positive and showing gliosis of the deep white periventricular and subcortical matter[9]. According to the classification system and case definition proposed by Shah and colleagues this case was possibly acquired intrapartum and transversal infection was possible[10].

No specific clinical finding has been described in newborns, but severe neonatal infections are possible. Variable body temperature, respiratory symptoms (cough, tachypnea, apnea, grunting, nasal flaring), tachycardia, lethargy, vomiting, diarrhea, and abdominal distention have been described. In our patient expected cardiac (major cardiac anomaly, obstructive septal hypertrophic obstructive cardiomyopathy) and pulmonary (surfactant consumption) complications associated with uncontrolled diabetes were not present. Our patient developed pneumonia that required mechanical ventilation with findings consistent with the reported literature: subpleural consolidations, interstitial pattern, and confluent B-lines; with an improvement after ventilatory management with consolidations disappearing and B-lines pattern progressive reduction. Treatment is symptomatic including respiratory support, fluid-electrolyte balance, maintaining hemodynamic stability and parenteral or enteral nutrition.

Conclusions

Our case represents a severe presentation of COVID-19 pneumonia with pulmonary hypertension requiring mechanical ventilation. LUS showed to be useful for diagnosis and follow up of the patient. Transversal infection was possible.

Declarations

STUDY FUNDING

None

DISCLOSURE

The authors report no relevant disclosures.

COMPETING INTERESTS

Authors declare no competing interests.

ETHICS DECLARATION

Case report was approved for the study by our local investigation ethics committee. Written consent from the family for hospitalization and management was obtained. For publication, the need for consent was waived by the approving ethics committee.

DATA AVAILABILITY

Additional information from studies performed is available from the corresponding author on reasonable request.

References

1. Duran P, Berman S, Niermeyer S, et al. COVID-19 and newborn health: systematic review. *Rev Panam Salud Publica*. 2020;44:e54. doi:10.26633/RPSP.2020.54.
2. Soldati G, Smargiassi A, Inchingolo R, et al. Is There a Role for Lung Ultrasound During the COVID-19 Pandemic?. *J Ultrasound Med*. 2020;39(7):1459-1462. doi:10.1002/jum.15284
3. Feng XY, Tao XW, Zeng LK, Wang WQ, Li G. *Zhonghua Er Ke Za Zhi*. 2020;58(5):347-50. doi:10.3760/cma.j.cn112140-20200228-00154
4. Denina M, Scolfaro C, Silvestro E, et al. Lung Ultrasound in Children With COVID-19. *Pediatrics*. 2020;146(1):e20201157. doi:10.1542/peds.2020-1157
5. Gregorio-Hernández R, Escobar-Izquierdo AB, Cobas-Pazos J, Martínez-Gimeno A. Point-of-care lung ultrasound in three neonates with COVID-19. *Eur J Pediatr*. 2020;179(8):1279-1285. doi:10.1007/s00431-020-03706-4
6. Kim DJ, Jelic T, Woo MY, Heslop C, Olszynski P. Just the Facts: Recommendations on point-of-care ultrasound use and machine infection control during the coronavirus disease 2019 pandemic. *CJEM*. 2020;22(4):445-449. doi:10.1017/cem.2020.364
7. Zeng L, Xia S, Yuan W, et al. Neonatal Early-Onset Infection With SARS-CoV-2 in 33 Neonates Born to Mothers With COVID-19 in Wuhan, China [published online ahead of print, 2020 Mar 26]. *JAMA Pediatr*. 2020;174(7):722-725. doi:10.1001/jamapediatrics.2020.0878
8. Algarroba GN, Rekawek P, Vahanian SA, et al. Visualization of severe acute respiratory syndrome coronavirus 2 invading the human placenta using electron microscopy. *Am J Obstet Gynecol*. 2020;223(2):275-278. doi:10.1016/j.ajog.2020.05.023
9. Vivanti AJ, Vauloup-Fellous C, Prevot S, et al. Transplacental transmission of SARS-CoV-2 infection. *Nat Commun*. 2020;11(1):3572. Published 2020 Jul 14. doi:10.1038/s41467-020-17436-6

10. Shah PS, Diambomba Y, Acharya G, Morris SK, Bitnun A. Classification system and case definition for SARS-CoV-2 infection in pregnant women, fetuses, and neonates. *Acta Obstet Gynecol Scand*. 2020;99(5):565-568. doi:10.1111/aogs.13870

Table

Table 1.

Admission laboratory exams	
WBC (×109/L)	11.3
L% (%)	51
PLT (×109/L)	105
Hb (g/L)	160
CRP (mg/L)	<0.5
ALT (U/L)	17
AST (U/L)	49
BUN (mg/dl)	1.42
sCr (μmol/L)	36
CK-MB (U/L)	80
PT (s)	12.1
APTT (s)	21

WBC, white blood cell; L%, percentage of Lymphocyte; PLT, Platelet count; Hb, hemoglobin; CRP, C-reactive protein; ALT, alanine aminotransferase; AST, aspartate aminotransferase; BUN, blood urea Nitrogen; sCr, serum creatinine; CK-MB, creatine kinase-MB; PT, prothrombin time;; APTT, activated partial thromboplastin time.

Figures

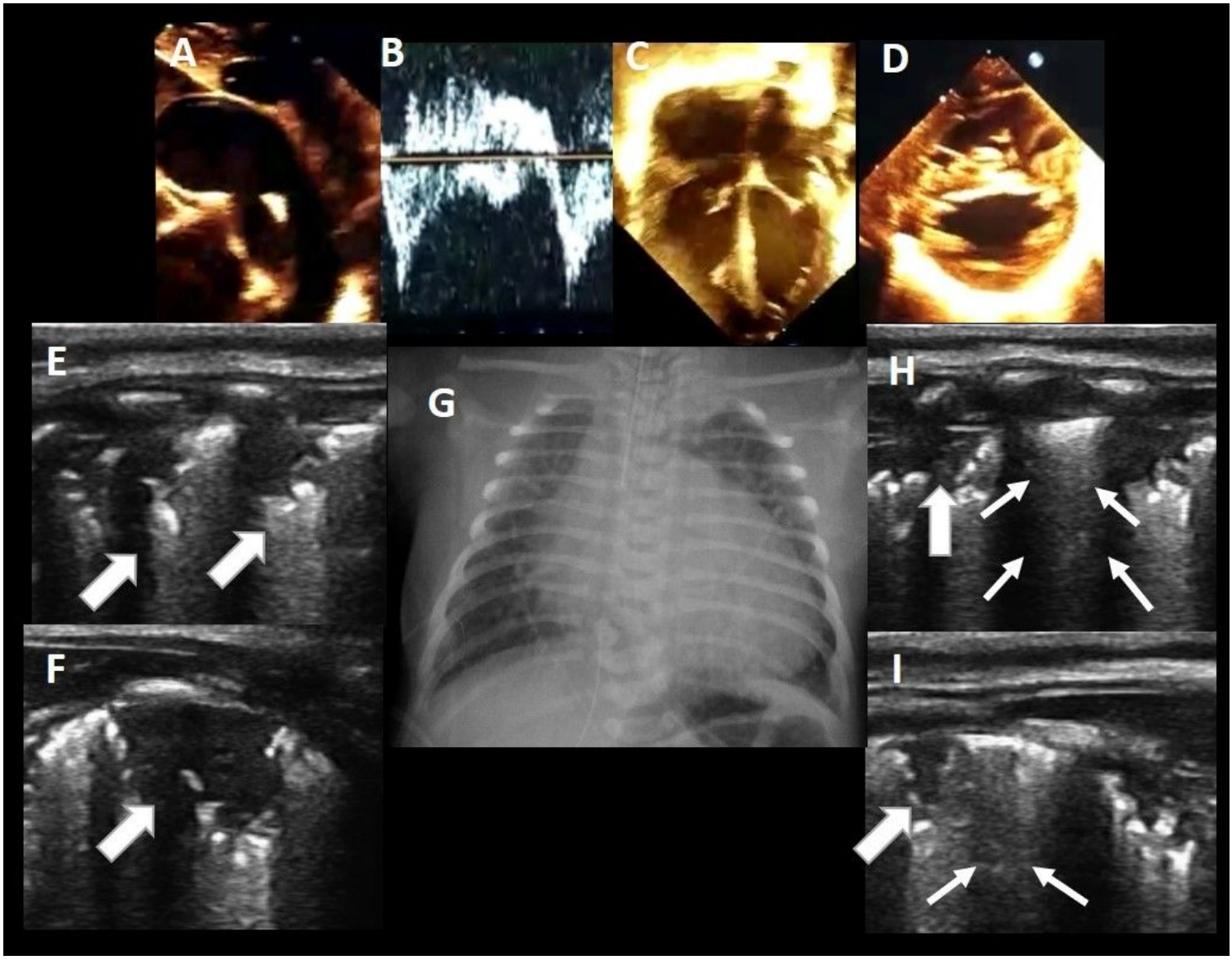

Figure 1

Radiologic and ultrasonographic findings on admission. A. 6 mm PDA; B. Pulsed doppler showing bidirectional, right to left on systole flow; C. Right ventricular dilatation; D. Flat interventricular septum on systole; E. (longitudinal view) – F. (transverse view): Posterior right LUS scan showing shred sign and subpleural consolidation (thick arrows); G. Chest radiography with cardiomegaly and ground-glass opacities; H. (longitudinal view) – I. (transverse view): Posterior left LUS scan showing shred sign, subpleural consolidation and confluent B-lines (thin arrows).

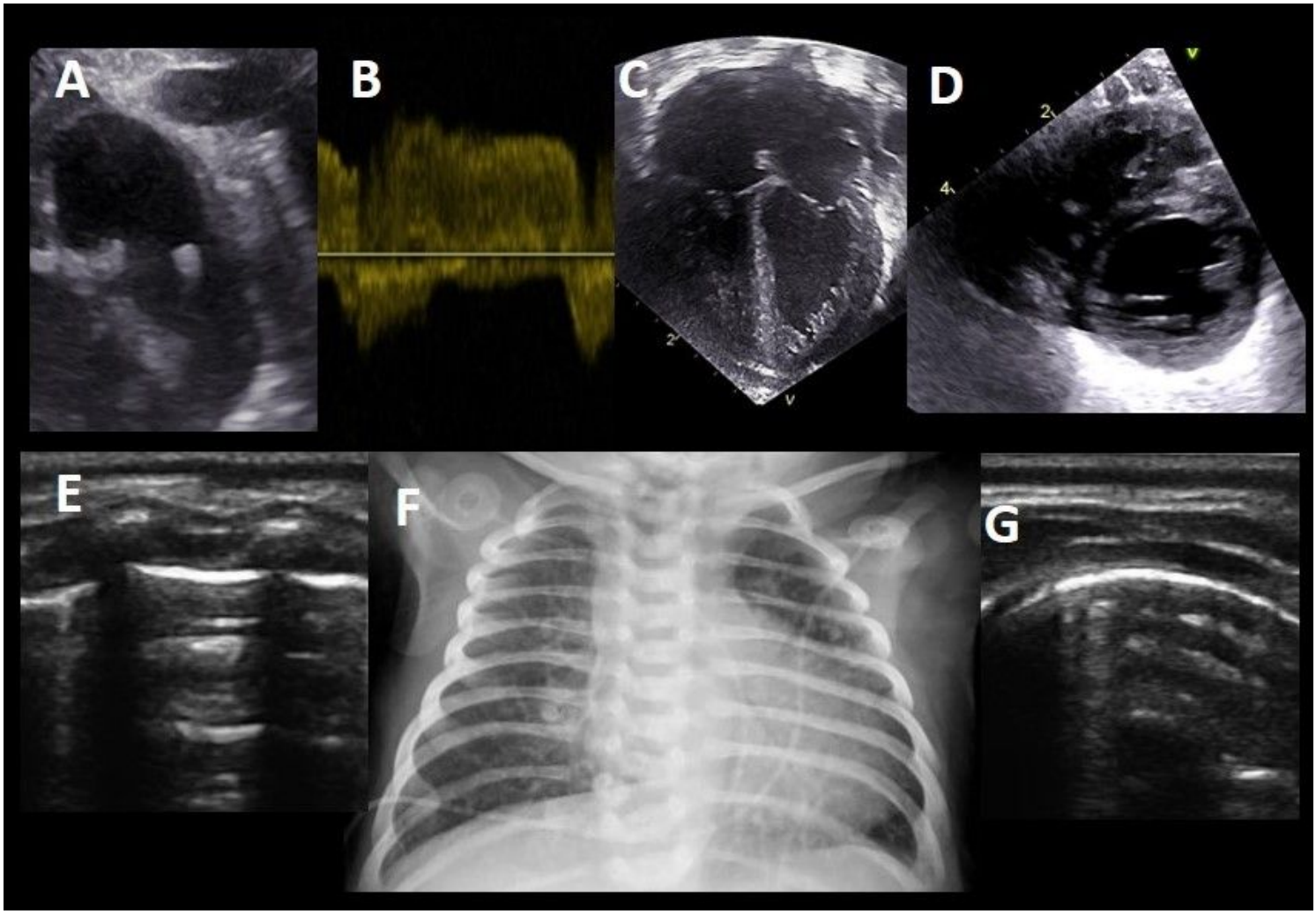

Figure 2

Radiologic and ultrasonographic findings prior to discharge. A. 1.9 mm PDA; B. Continuous doppler showing left to right restrictive left to right flow; C. Improvement of biventricular dilatation; D. Round interventricular septum on systole; E. (longitudinal view) normal LUS; F. Chest radiography with improvement of cardiomegaly and disappearance of ground-glass opacities. G. (transverse view): normal LUS.

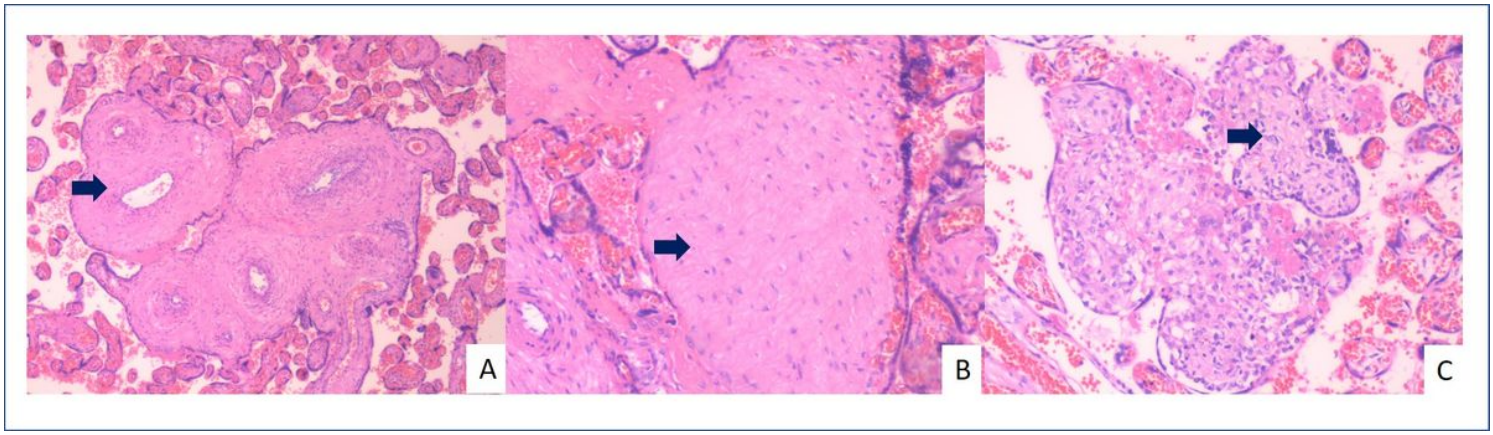

Figure 3

Histopathological study of the placenta. A) Histological sections with H&E shows fibrosclerosis of the great vasculature of the chorionic plaque. (10x) (arrow) B) The villi show stromal fibrosis [avascular villi, (10x), (arrow)] C) Villous shows chronic villitis and intervillitis constituted by macrophages mainly (arrow).