

Brief Report

Constriction of the ductus arteriosus, severe right ventricular hypertension, and a right ventricular aneurysm in a fetus after maternal use of a topical treatment for striae gravidarum

Denise A. Hayes

Steven and Alexandra Cohen Children's Medical Center – North Shore-LIJ Health System, Division of Pediatric Cardiology, New Hyde Park, New York, United States of America

Abstract Fetal constriction of the ductus arteriosus is a complication of maternal non-steroidal anti-inflammatory drug use and polyphenol-rich food intake. It is unclear as to whether polyphenol-containing topical treatments have similar effects. We present a case of fetal constriction of the ductus arteriosus, severe right ventricular hypertension, and a right ventricular aneurysm associated with maternal use of a topical treatment for striae gravidarum.

Keywords: Fetal echocardiography; ductus arteriosus constriction; ventricular aneurysm

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FETAL CONSTRICTION OF THE DUCTUS ARTERIOSUS IS a possibly underestimated phenomenon.^{1–3} Although most cases are due to maternal use of non-steroidal anti-inflammatory drugs, polyphenol-rich substances such as teas and certain foods have recently been implicated.¹ We present the case of a fetus with ductus arteriosus constriction, right heart failure, and a right ventricular aneurysm associated with maternal use of Bio-Oil[®], a biologically active topical treatment for striae gravidarum – that is, “stretch marks”.

Case report

A 33-year-old woman was referred for fetal echocardiography at 36 weeks and 5 days of gestation for a pericardial effusion. A comprehensive fetal echocardiogram (Fig 1) demonstrated normal cardiac anatomy, a moderately dilated right atrium, a moderately dilated and hypertrophied right ventricle, severe right ventricular hypokinesia, moderate tricuspid regurgitation (peak velocity 4.0 m/second),

and a small circumferential pericardial effusion. A right ventricular apical aneurysm (1.3 × 1.0 cm) was observed. The cardiothoracic area ratio was increased (0.46). Doppler interrogation of the ductus arteriosus demonstrated increased systolic and diastolic velocities (3.2 and 2.3 m/second, respectively) as well as decreased pulsatility index (0.35). There was reversed end-diastolic ductus venosus flow. The patient denied use of oral medications – including non-steroidal anti-inflammatory drugs and herbal supplements – or intake of excessive quantities of polyphenol-rich foods or beverages. Upon further questioning, she reported application of Bio-Oil[®] (registered trademark of Geneva Laboratories Limited, British Virgin Islands; manufactured in South Africa) twice daily to her abdomen, starting during the second trimester.

A male infant weighing 3 kg was delivered by emergent caesarean section. Initial oxygen saturation was 60%, which normalised on supplemental oxygen. His chest radiograph demonstrated an enlarged cardiac silhouette with normal pulmonary vascularity. The electrocardiogram was significant for right atrial enlargement and non-specific T-wave abnormalities in the right pre-cordial leads. An echocardiogram at

Correspondence to: D. A. Hayes, Steven and Alexandra Cohen Children's Medical Center – North Shore-LIJ Health System, Division of Pediatric Cardiology, 269-01 76th Avenue, Suite 139, New Hyde Park, NY 11040, United States of America. Tel: +718 470 7350; Fax: +718 347 5864; E-mail: dhayes2@nshs.edu

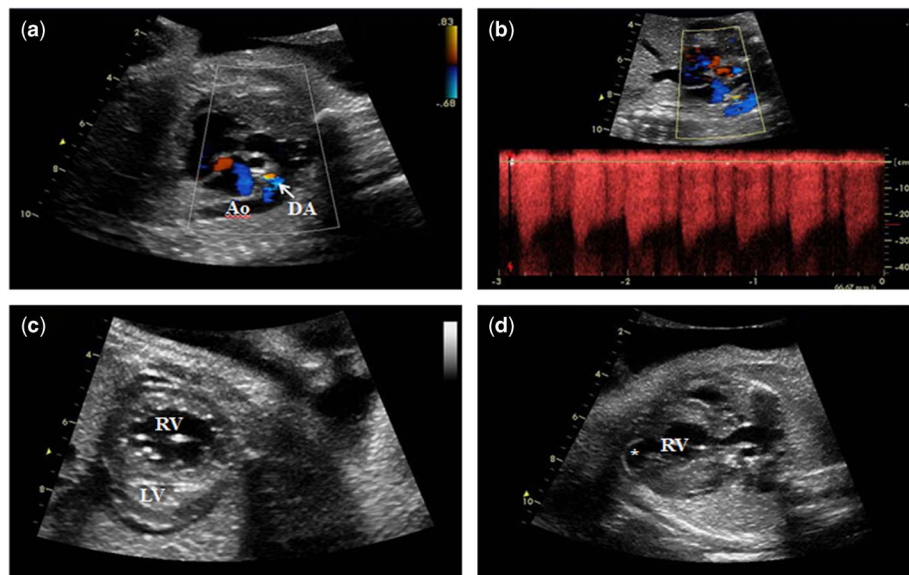


Figure 1.

*Fetal constriction of the ductus arteriosus. (a) Severely constricted ductus arteriosus, with high-velocity flow into the aorta. (b) Ductus arteriosus Doppler with increased systolic and diastolic velocities, decreased pulsatility index. (c) Dilation and hypertrophy of the right ventricle, posterior systolic bowing of the interventricular septum, compression of the left ventricular cavity, and a small pericardial effusion. (d) Thinning of the myocardium with aneurysm formation at the right ventricular apex. Ao = aorta; DA = ductus arteriosus; LV = left ventricle; RV = right ventricle; *aneurysm.*

1 hour of life demonstrated right-to-left foramen ovale shunting, moderately depressed right ventricular systolic function (improved compared to the fetal study), trivial tricuspid regurgitation (inadequate for Doppler estimation of pulmonary artery pressure), the previously noted right ventricular aneurysm, and no patent ductus arteriosus. Pulmonary artery pressure was estimated at suprasystemic level based on posterior systolic bowing of the interventricular septum.

The infant was admitted to the neonatal ICU, where respiratory support was weaned off over the next 24 hours. He was discharged within 6 days, after a follow-up echocardiogram showed a decrease in size of the right ventricular aneurysm (to 0.4×0.4 cm), flattening of the interventricular septum, and mild improvement in right ventricular function. An outpatient follow-up echocardiogram at 4 months of age demonstrated no interatrial shunt, normalisation of the estimated pulmonary artery pressure and right ventricular function, and complete resolution of the pericardial effusion and right ventricular aneurysm.

Discussion

The diagnosis of fetal constriction of the ductus arteriosus is made when fetal echocardiography demonstrates turbulent, continuous ductal Doppler

flow, increased systolic and diastolic velocities, and a decreased pulsatility index.¹ Fetal constriction of the ductus arteriosus may also be suspected in neonates who present with signs of pulmonary hypertension, and whose immediate postnatal echocardiograms demonstrate right ventricular hypertrophy and the lack of significant patency of the ductus arteriosus shortly after birth. The delayed postnatal drop in pulmonary vascular resistance results from increased fetal blood flow to the pulmonary vasculature, with medial hypertrophy of the muscular pulmonary arteries. Likely depending on the degree and duration of constriction, the neonate may be asymptomatic or may present with severe refractory pulmonary hypertension and cardiorespiratory failure.³

Maternal use of non-steroidal anti-inflammatory drugs causes fetal ductal constriction by inhibiting the synthesis of prostaglandins, which normally maintain ductal patency. Most of the reported cases have been associated with maternal non-steroidal anti-inflammatory drugs use, but spontaneous ductal constriction has also been described.³ Recently, it has become evident that certain foods, herbs, and teas affect the synthesis of prostaglandins as well, implicating these common substances in fetal ductus arteriosus constriction during the third trimester.²

The biological activity of polyphenols, especially flavonoids, has sparked the interest of the health

and wellness industry and manufacturers of anti-inflammatory and antioxidant therapies.² Polyphenols are found in abundance in certain herbal teas, fruits such as oranges, grapes, and berries, vegetables such as green spices and tomatoes, as well as in dark chocolate, olive oil, and soyabean.^{2,4} By inhibiting the pathway of prostaglandin synthesis, polyphenols demonstrate anti-inflammatory and antioxidant effects that are largely beneficial to the general population.^{1,5} By these same mechanisms, however, maternal consumption in late pregnancy may be detrimental to the fetus by altering flow mechanics in the ductus arteriosus.¹

Fortunately, when the offending agent is identified and discontinued, there is most often normalisation of the echocardiographic findings before birth.^{1,5} Even in those neonates who demonstrate signs of pulmonary hypertension after delivery, complete resolution can be expected within the first few months of life in those who survive.¹ In a subset of patients, fetal ductal constriction can result in fetal hydrops, fetal demise, or significant postnatal morbidity and mortality.

Topical herbal therapies rich in polyphenols have not been previously associated with this phenomenon. Bio-Oil[®] is a topical treatment marketed to pregnant women with the goal of improving the appearance of striae gravidarum.⁶ The manufacturer recommends applying the oil twice daily to areas that are prone to striae, starting during the second trimester.⁶ Ingredients include botanical substances that contain polyphenols, such as *Calendula officinalis* extract, *Lavandula angustifolia* oil, *Rosmarinus officinalis* leaf oil, and *Anthemis nobilis* flower oil.^{6–9}

To our knowledge, this is the first reported case of fetal ductus arteriosus constriction associated with a topical herbal therapy. This case is also unique in that a right ventricular aneurysm, presumably the result of severe right ventricular hypertension, decreased right coronary perfusion pressure, and myocardial ischaemia, formed prenatally but began to regress shortly after birth. Despite the history of severe fetal right heart failure, the neonate demonstrated rapid clinical and echocardiographic improvement after emergent delivery.

In conclusion, biologically active oils and creams that contain polyphenols may be associated with fetal constriction of the ductus arteriosus. Further investigation is necessary to determine whether there is a causal relationship between fetal ductal constriction and the frequent application of these topical therapies during pregnancy.

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Conflicts of Interest

None.

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