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Minimally invasive therapeutic approach to fetal congenital pulmonary airway malformation: Case report and literature review

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Ethical Approval
This study was reviewed and approved by the Research Ethics Committee of Hospital Materno Infantil Presidente Vargas (HMIPV), Porto Alegre, Brazil, through Plataforma Brasil (CAAE No. 92927625.4.0000.5329; Ethics Committee Approval No. 7.981.838; approved on November 17, 2025). The study was conducted in accordance with the applicable Brazilian ethical and regulatory requirements for research involving human participants.

Informed Consent
Written informed consent for publication of this case was obtained from the child's legal guardian, who is directly responsible for the minor. The legal guardian voluntarily authorized the use and publication of the child's clinical data and medical images for scientific and educational purposes. The consent included authorization for dissemination in scientific presentations and publications, with preservation of the patient's anonymity and confidentiality. No information that could directly identify the child is disclosed in this manuscript.

Conflict of Interest
No conflict of interest was declared by the authors.

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Abstract

Congenital pulmonary airway malformation (CPAM) is a rare fetal condition associated with substantial morbidity and mortality, particularly when complicated by hydrops fetalis. Minimally invasive fetal therapies have emerged as alternatives to open fetal surgery, with the goals of reducing lesion volume, improving survival, and minimizing maternal morbidity. We report a hydropic fetus with a solid-appearing left thoracic lesion and a central feeding vessel, initially interpreted as a hybrid CPAM/pulmonary sequestration lesion. After maternal betamethasone failed to control disease progression, ultrasound-guided intralesional sclerotherapy with 5% monoethanolamine oleate (Ethamolin®; 50 mg/mL) was performed at 27 weeks' gestation. Follow-up ultrasonography showed a reduction in lesion size and a decrease in the CPAM volume ratio (CVR) from 2.58 to 1.29, with complete resolution of hydrops. The pregnancy progressed to term, and postnatal surgical resection and histopathologic examination confirmed pulmonary sequestration. To contextualize this experience, we also reviewed the literature on minimally invasive prenatal treatment of solid-appearing CPAM and pulmonary sequestration. Across the available reports, laser ablation predominated in pulmonary sequestration, whereas sclerotherapy progressively replaced laser therapy in solid CPAM. Among the reported sclerosants, ethanolamine appears to offer the most consistent balance of feasibility, low cost, and favorable fetal response, although careful Doppler-guided injection is essential to avoid intravascular complications.

Keywords: congenital pulmonary airway malformation, pulmonary sequestration, fetal therapy, sclerotherapy, minimally invasive surgery, hydrops fetalis, ethanolamine

Introduction

Congenital pulmonary airway malformation (CPAM) and pulmonary sequestration (PS) are uncommon fetal thoracic lesions that may have similar prenatal imaging findings but differ in embryology, vascular anatomy, postnatal pathology, and therapeutic approach [1-4]. Both lesions may behave as expansile intrathoracic masses, compressing adjacent lung tissue, shifting the mediastinum, impairing venous return, and, in severe cases, progressing to hydrops fetalis with a very high risk of fetal or neonatal death [1, 3, 4].

Prenatal treatment is directed at reducing mass effect and restoring thoracic physiology. Current management options include maternal corticosteroids, thoracocentesis or thoracoamniotic shunting for macrocystic lesions, laser or embolization techniques for lesions with a dominant feeding vessel, and open fetal surgery in selected refractory cases [5-10]. Although open fetal resection can be lifesaving, it carries substantial fetal risk and clinically relevant maternal morbidity, including uterine scarring and implications for future pregnancies [6, 7].

For predominantly solid lesions complicated by hydrops that do not respond to corticosteroids, minimally invasive intralesional or intravascular therapies have gained attention as potentially effective alternatives to open surgery [11-36]. The aim of this report is to describe the management of a hydropic fetus with a solid-appearing thoracic lesion treated with ultrasound-guided ethanolamine sclerotherapy after failed corticosteroid therapy and to synthesize the literature on minimally invasive treatment for similar fetal presentations.

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Case presentation

A 39-year-old pregnant woman (G2P1) was referred to the fetal medicine department of Hospital Materno Infantil Presidente Vargas on January 17, 2024, at 21 weeks and 1 day of gestation, with fetal hydrops and a hyperechoic heterogeneous lesion in the left hemithorax measuring 6.1 × 4.5 × 3.3 cm. The lesion caused rightward mediastinal deviation, and the CPAM volume ratio (CVR) was 2.39. Doppler assessment demonstrated a central feeding vessel arising from the thoracic aorta, raising the initial diagnostic hypothesis of a hybrid CPAM with a sequestration component. A detailed fetal ultrasound examination was performed on February 15, 2024, at 25 weeks and 2 days of gestation (Figure 1), confirming persistence of the lesion with features suggestive of hybrid CPAM/sequestration and ongoing hydrops.

Maternal betamethasone was administered on January 17 and January 25, 2024; however, no significant clinical or sonographic improvement was observed. Because hydrops persisted and the lesion remained clinically significant, ultrasound-guided intralesional sclerotherapy with 5% monoethanolamine oleate (Ethamolin®; 50 mg/mL) was indicated. The procedure was performed on February 27, 2024, at 27 weeks' gestation, when the lesion measured 5.5 × 5.2 × 4.6 cm and the CVR was 2.58. Under maternal sedation to minimize maternal and fetal movement, a 22-gauge needle was introduced into the lesion, and 3.0 mL of 5% monoethanolamine oleate (Ethamolin®; 50 mg/mL) was injected using a fan-shaped technique under continuous Doppler monitoring. Figure 2 shows an ultrasound image obtained during sclerotherapy.

Ultrasound follow-up on March 12, 2024, at 29 weeks' gestation showed a reduction in lesion size to 5.1 × 3.9 × 3.5 cm, with a CVR of 1.29 and complete resolution of hydrops (Figure 3). The pregnancy subsequently progressed to 38 weeks, when cesarean delivery was indicated because of preeclampsia. A male newborn was delivered on May 14, 2024, with Apgar scores of 6 and 8 at 1 and 5 minutes, respectively, and a birth weight of 2,890 g. Mechanical ventilation was not required; continuous positive airway pressure was used only during the first hours of life.

Postnatal computed tomography performed on May 21, 2024, demonstrated a heterogeneous lesion in the posterior basal segment of the left lower lobe measuring 4.0 × 3.0 × 3.5 cm. The newborn underwent thoracotomy with segmentectomy on June 17, 2024. Histopathologic examination confirmed pulmonary sequestration measuring 5.1 × 4.2 × 3.4 cm. The infant was discharged in good clinical condition on July 1, 2024 (Figure 4).

Literature review strategy

A literature review was conducted in MEDLINE, Embase, and LILACS in May 2025, without restrictions on publication year, language, or country. The search combined MeSH terms and free-text keywords related to CPAM, pulmonary sequestration, fetal therapy, minimally invasive treatment, laser ablation, sclerotherapy, radiofrequency, and percutaneous intervention (Supplementary material 1). After duplicate removal and eligibility assessment, 26 studies were included: 14 concerning predominantly solid CPAM and 12 concerning PS (Figure 5).

Figure 1. Prenatal sonographic appearance of the thoracic mass.

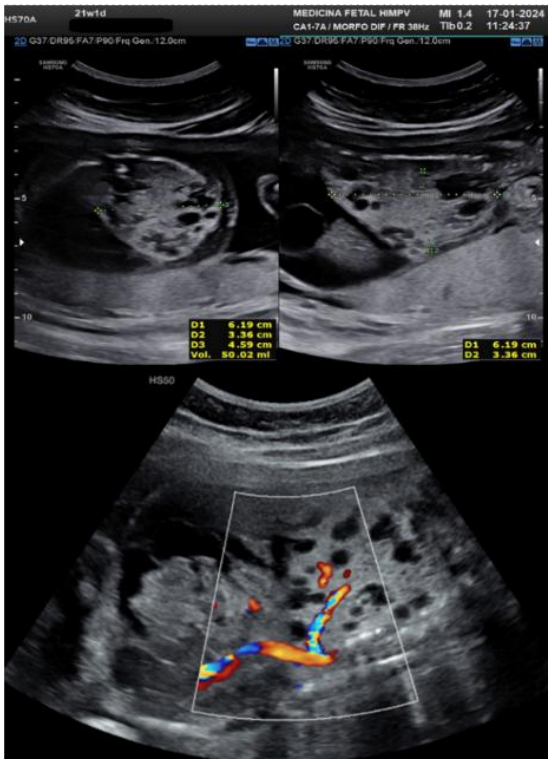

Figure 2. Ultrasound image obtained during sclerotherapy.

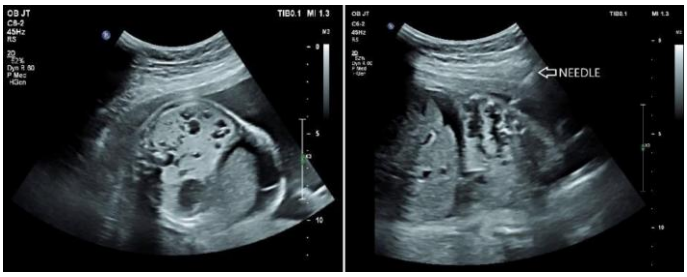

Figure 3. Ultrasound follow-up 2 weeks after sclerotherapy.

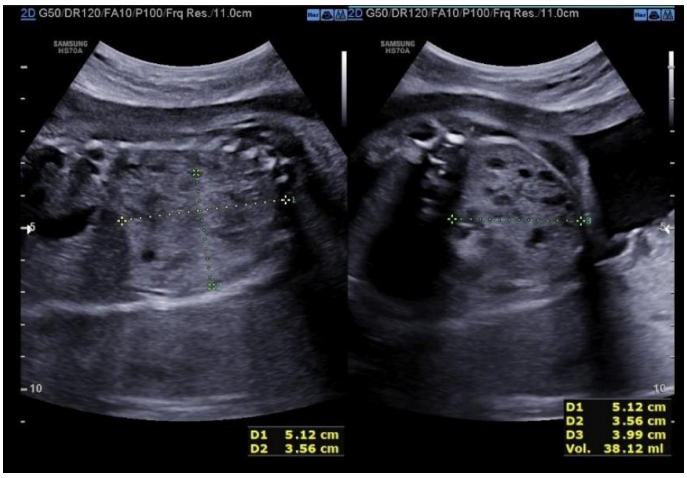

Figure 4. Postnatal computed tomography scan of the neonatal thorax.

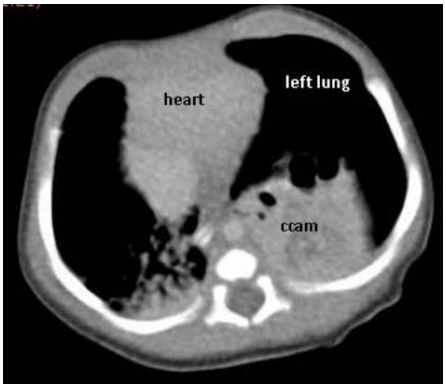

Figure 5. Flowchart of study selection.

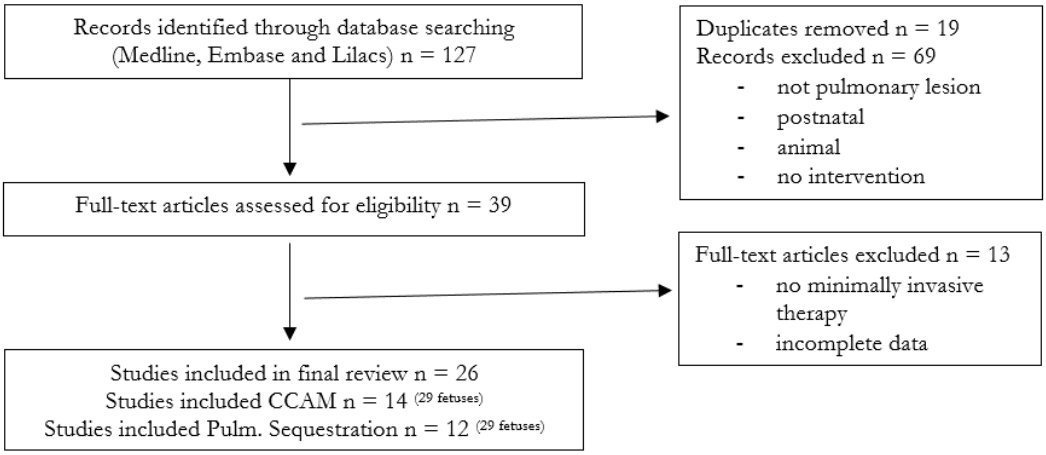

Table 1. Literature review of minimally invasive treatment for predominantly solid CPAM.

First author – year – journal	Type of study / sample	Fetal ultrasound diagnosis	CVR	Steroid use	Minimally invasive therapy	GA at therapy (weeks)	Intervention details	Therapy results
Fortunato SJ et al. (1997) Am J Obstet Gynecol [13]	Case report (n=1)	Type III CCAM	Not reported	No	Laser ablation	21 and 23	YAG laser therapy was performed using 16 W at 21 and 23 weeks of gestation (double dose).	Cardiac axis returned to normal; lung growth documented.
Bruner JP et al. (2000) Fetal Diagn Ther [14]	Case report (n=1)	Type III CCAM	Not reported	No	Laser ablation	23 and 24	YAG laser therapy was performed using 15 W at 23 and 24 weeks (double dose).	Fetal demise at 25 weeks.
Davenport M et al. (2004) J Pediatr Surg [15]	Retrospective case series (n=3)	Type II–III CCAM	Not reported	No	Laser ablation (n=1)	19–31	YAG laser therapy at 19 and 31 weeks (double dose).	Hydrops resolution and uneventful birth at 38 weeks (two other cases did not receive therapy).
Ong SS et al. (2006) Fetal Diagn Ther [16]	Case report (n=1)	Type III CCAM	Not reported	No	Laser ablation	22	YAG laser therapy was performed using 45 W.	Term birth; lobectomy 48 h after birth.
Cavoretto P et al. (2008) Ultrasound Obstet Gynecol [17]	Case report (n=1)	Type III CCAM	Not reported	No	Laser ablation	23 and 31	YAG laser therapy was performed using 30–50 W (double dose).	Term birth and neonatal demise due to pulmonary hypoplasia.
Bermúdez C et al. (2008) Fetal Diagn Ther [18]	Retrospective case series (n=3)	Type II and III CCAM	Not reported	No	Sclerotherapy with polidocanol 3% or ethanolamine oleate 5%	21–26	Case 1: ethanolamine oleate 5%, 1.5 mL. Cases 2 and 3: polidocanol 3%, 2 mL.	Cases 1 and 3: term birth and normal newborn. Case 2: term birth, neonatal lobectomy, death from nosocomial sepsis.
Sepulveda W et al. (2010) J Ultrasound Med [19]	Case report (n=1)	Hybrid type III CCAM and PS	Not reported	No	Embolization with N-butyl-2-cyanoacrylate	22	NBCA 2 mL injected into the largest vessel supplying the tumor.	Hydrops resolution at 25 weeks and term birth.
Lee FL et al. (2012) Fetal Diagn Ther [20]	Retrospective case series (n=3)	Type II–III CCAM	Case 1: 7.8; Case 2: 3.4; Case 3: 3.9	Yes (n=1)	Sclerotherapy with ethanolamine oleate 5%	19–33	Cases 1 and 2: ethanolamine oleate 5%, 2 mL. Case 3: ethanolamine oleate 5%, 4 mL.	Cases 1 and 3: hydrops resolution and term birth. Case 2: term birth, low Apgar score, minor neurological sequelae.
Ruano R et al. (2012) Prenat Diagn [21]	Retrospective case series (n=3)	Type III CCAM	Not reported	No	Laser ablation	<32	YAG laser therapy was performed using 30–40 W.	Fetal death after the procedure (n=1) and premature birth followed by neonatal death (n=2).
Juárez-García L et al. (2015) Ginecol Obstet Mex [22]	Case report (n=1)	Type II CCAM	Not reported	No	Sclerotherapy with polidocanol 3%	24	Polidocanol 3%, 1.5 mL.	Born at 39+4 weeks and required ventilatory support; postnatal lobectomy; hydrops persisted until term.
Cruz-Martínez R et al. (2015) Fetal Diagn Ther [23]	Case report (n=1)	Type III CCAM (bronchial atresia?)	4.2	Yes	Fetal bronchoscopy	30	Clearance of the upper airway with a 3-mm endoscope and laser ablation of the bronchial membrane at 10 W.	Born at 38+6 weeks; no ventilatory support or lesion resection required.
Chon AH et al. (2018) Prenat Diagn [24]	Retrospective case series (n=8)	Type II–III CCAM	1.7 to 7.8	Yes (n=4)	Sclerotherapy with ethanolamine oleate 5%	19–31	Ethanolamine oleate 5%, 2.0 to 10.0 mL (average 5.5 mL).	Six favorable outcomes; one death after intravascular injection; one death following severe preprocedural bradycardia.
Abbasi N et al. (2020) Fetal Diagn Ther [25]	Case report (n=1)	Type III CCAM	2.78	Yes	Sclerotherapy with sodium tetradecyl sulfate 3%	23	STS 3%, 2 mL.	Term birth with normal Apgar score.
Klinkner DB et al. (2022) Fetal Diagn Ther [26]	Case report (n=1)	Giant mixed II–III CCAM	1.9	Yes	Radiofrequency ablation	22	Three ablation points, from 50 W to 80 W, monitored by local gas release.	Term birth with a low Apgar score (1–8).

Abbreviations: CCAM: congenital cystic adenomatoid malformation, CPAM: congenital pulmonary airway malformation, CVR: CPAM volume ratio, GA: gestational age, NBCA: N-butyl-2-cyanoacrylate, PS: pulmonary sequestration, STS: sodium tetradecyl sulfate, YAG: yttrium aluminum garnet.

Table 2. Literature review of minimally invasive treatment for pulmonary sequestration.

First author – year – journal	Type of study / sample	Fetal ultrasound diagnosis	CVR	Steroid use	Minimally invasive therapy	GA at therapy (weeks)	Intervention details	Therapy results
Ruano R et al. (2007) J Ultrasound Med [28]	Case report (n=1)	Pulmonary sequestration	Not reported	No	Laser ablation of feeding artery	29	YAG laser therapy was performed using 35 W.	Term birth and neonatal lobectomy on day 15.
Oepkes D et al. (2007) Ultrasound Obstet Gynecol [29]	Case report (n=1)	Pulmonary sequestration	Not reported	No	Laser ablation of feeding artery	23	YAG laser therapy was performed using 20–50 W.	Term birth and no tumor resection performed.
Bermúdez C et al. (2007) Ultrasound Obstet Gynecol [27]	Case series (n=3)	Pulmonary sequestration	Not reported	No	Sclerotherapy with polidocanol 3% (feeding artery)	24–26	1 mL polidocanol 3% injected into the feeding artery.	Hydrops resolution and term birth; one death after lobectomy complications.
Witlox RSGM et al. (2009) Ultrasound Obstet Gynecol [30]	Case report (n=1)	Pulmonary sequestration	Not reported	No	Laser ablation of feeding artery + drainage	23	Nd:YAG laser at 20 W, followed by drainage of hydrothorax and hydramnios through the same needle.	Term birth with normal Apgar score.
Rammos KS et al. (2010) Interact Cardiovasc Thorac Surg [31]	Case report (n=2)	Extralobar pulmonary sequestration	Not reported	No	Laser ablation of feeding artery + pleural drainage/shunt	28 and 31	Prenatal laser treatment with pleural drainage and pleuroamniotic shunt; second laser session in one case.	Cases 1 and 2: postnatal thoracotomy and good long-term outcomes.
Baud D et al. (2013) Ultrasound Obstet Gynecol [32]	Prospective case series (n=3)	Pulmonary sequestration	Not reported	No	Laser ablation / radiofrequency / coil embolization	17–25	Case 1: laser 50 W. Case 2: radiofrequency 100 W. Case 3: thrombogenic coil embolization.	Case 1: term birth, healthy infant. Case 2: preterm birth and neonatal death after severe procedure-related complications. Case 3: intrauterine death after embolization.
Mallmann MR et al. (2014) Ultrasound Obstet Gynecol [33]	Retrospective cohort (n=5)	Pulmonary sequestration with severe pleural effusion	Not reported	No	Laser ablation of feeding artery	24–31	Nd:YAG laser through an 18-G needle; 50 W with repeat coagulation if residual flow persisted.	All five laser-treated fetuses showed regression and were delivered at term.
Kosinski P et al. (2017) Ultraschall Med [34]	Case report (n=2)	Pulmonary sequestration	Not reported	No	Laser ablation of feeding artery	22 and 27	Case 1: diode laser 35 W. Case 2: Nd:YAG laser 50 W with pleural drainage.	Case 1 and 2: term delivery with normal Apgar score.
Ichino M et al. (2020) Eur J Pediatr Surg Rep [35]	Case report (n=2)	Complicated extralobar pulmonary sequestration	Not reported	No	Laser ablation of feeding artery	26 and 31	Diode laser, 15–20 W, followed by postnatal MRI/CT surveillance and thoracoscopic resection.	Both neonates were born asymptomatic at 38 weeks; residual lesions were resected thoracoscopically.
Ruano R et al. (2020) Fetal Diagn Ther [37]	Case report (n=1)	Bronchopulmonary sequestration	2.8 in one case	Yes in one case	Laser ablation of feeding artery	27	YAG laser 25 W.	Term birth with normal Apgar score in the index case.
Grozdeva L et al. (2021) Fetal Diagn Ther [9]	Narrative review (n=1)	Bronchopulmonary sequestration with hydrops	Reported variably	Yes in selected cases	Vascular laser ablation	28–31	Diode laser 30 W under ultrasound guidance; associated amniodrainage/thoracentesis in selected cases.	Term birth with normal Apgar score.
Zanini A et al. (2022) Eur J Pediatr Surg [36]	Retrospective case series (n=5)	Bronchopulmonary sequestration	Not reported	No	Prenatal ultrasound-guided laser coagulation	24–31	Diode laser 15–20 W; thoracocentesis or shunt as adjunct when needed.	Cases 1–4: term birth with normal Apgar scores. Case 5: follow-up unavailable in the local series.

Abbreviations: CT: computed tomography, CVR: CPAM volume ratio, GA: gestational age, MRI: magnetic resonance imaging, Nd:YAG: neodymium-doped yttrium aluminum garnet.

Literature review findings

Among the included studies, minimally invasive treatment of predominantly solid CPAM was reported in 14 publications comprising 29 fetuses, whereas 12 publications described 29 fetuses with pulmonary sequestration (PS). Reporting quality was heterogeneous, particularly for CVR values and prior corticosteroid use; however, the available outcome data allowed comparison of therapeutic effectiveness.

In CPAM, outcomes varied and appeared to depend on both the technique and preintervention severity. Overall, favorable outcomes, such as survival with resolution of hydrops or clinical stabilization, were reported in approximately 60-65% of cases, whereas fetal or neonatal mortality occurred in approximately 30-35%. Laser ablation, used predominantly in earlier studies, was associated with higher mortality, including fetal demise and early neonatal death in multiple reports. In contrast, sclerotherapy with ethanolamine, polidocanol, or sodium tetradecyl sulfate demonstrated more consistent resolution of hydrops and term delivery, with favorable outcomes reported in most treated cases.

Nevertheless, procedure-related complications were clinically important and included intravascular injection, cardiovascular instability, and postnatal infectious complications, indicating that treatment safety remains operator dependent.

In PS, outcomes were more consistently favorable across studies. Reported overall survival exceeded 85-90%, with most fetuses achieving resolution of hydrops or substantial clinical improvement after intervention. Laser coagulation or ablation of the feeding artery was the predominant technique and demonstrated high efficacy in reversing hydrothorax and hydrops, particularly when complete interruption of vascular flow was achieved. Several series reported near-complete survival with term delivery, especially in more recent cohorts using standardized techniques.

However, treatment of PS is not without risk. Isolated reports described procedure-related mortality, including intrauterine and neonatal deaths following severe hemodynamic instability or technical failure. In addition, a substantial proportion of cases required postnatal surgical resection of residual lesions even after apparent prenatal success, indicating that fetal therapy should be considered primarily lifesaving rather than definitive.

When the two conditions are compared, PS appears more amenable to minimally invasive fetal therapy than CPAM. This difference is likely related to the presence of a well-defined systemic feeding vessel, which allows targeted vascular intervention. In contrast, predominantly solid CPAM lesions often lack a single dominant vascular target, resulting in more heterogeneous responses and higher complication rates.

From a clinical perspective, these findings suggest that minimally invasive intervention should be strongly considered in fetuses with hydrops secondary to PS, for which the likelihood of reversal and survival is high. In CPAM, however, treatment decisions should be individualized by balancing potential benefits against a higher risk of mortality and procedural complications, particularly in cases with a very high CVR or advanced hydrops. The detailed characteristics and outcomes of the included studies are summarized in Tables 1 and 2.

Discussion

CPAM and PS share the capacity to produce a life-threatening intrathoracic mass effect during fetal life, but they are not interchangeable entities [1-4]. This distinction is clinically important because lesion morphology and vascular anatomy determine which minimally invasive option is most appropriate. Macrocystic CPAM may respond to decompressive procedures such as thoracocentesis or thoracoamniotic shunting, whereas PS is more suited to interruption of the feeding vessel. The greatest therapeutic challenge remains a predominantly solid lesion associated with hydrops, especially when corticosteroids fail [5, 8, 9, 11, 12].

In this setting, open fetal surgery has historically been used as salvage treatment, but its maternal and fetal risks are considerable [6, 7]. The literature reviewed here supports the current movement toward less invasive alternatives. In PS, laser ablation of the feeding artery has produced the most consistent results because it directly targets the lesion's vascular dependence [9, 28-37]. In contrast, outcomes in solid CPAM have been less predictable with laser-based destruction of parenchyma, and this technique has been reported mainly in earlier series [13-17, 21].

A clearer comparison among sclerosants is clinically more useful than repetition of individual study details. Ethanolamine was the most frequently reported sclerosant for solid CPAM and was associated with resolution of hydrops and term delivery in most treated fetuses [18, 20, 24]. Ethanolamine is an organic amine sclerosant that induces a local inflammatory reaction, leading to endothelial injury, fibrosis, and subsequent vascular occlusion at the injection site. Its main practical advantages are broad availability, low cost, and technical similarity to other ultrasound-guided needle procedures familiar to fetal therapy teams. The principal safety concern is inadvertent intravascular injection, which may cause catastrophic fetal cardiovascular injury; this risk underscores the need for continuous Doppler guidance and careful needle positioning [18, 20, 24].

Polidocanol was reported less often and generally with favorable fetal outcomes, but the evidence base is smaller and published descriptions are less complete regarding lesion evolution, CVR response, and the long-term neonatal course [18, 22]. Polidocanol is a nonionic surfactant derived from lauryl alcohol and ethylene oxide and exerts its sclerosing effect through endothelial disruption and thrombosis at the application site. In PS, intravascular use in the feeding vessel appears conceptually attractive, although the number of reported cases remains very limited [27].

Sodium tetradecyl sulfate has been described only in isolated CPAM cases, with encouraging short-term results but insufficient data for meaningful comparative conclusions [25]. It is an anionic sclerosing surfactant that causes endothelial injury, platelet aggregation, and thrombotic occlusion of targeted vessels.

Taken together, the available literature suggests that ethanolamine currently has the strongest practical support among sclerosants, whereas polidocanol and sodium tetradecyl sulfate remain promising but less well documented options.

Our case is consistent with that interpretation. After failure of maternal betamethasone, a single ultrasound-guided injection of 5% monoethanolamine oleate (Ethamolin®; 50

mg/mL) was followed by a marked decrease in CVR and complete resolution of hydrops, allowing the pregnancy to continue to term. The prenatal imaging appearance initially suggested a hybrid lesion, but postnatal pathology confirmed PS. This diagnostic transition is relevant because prenatal management must often proceed under imaging-based uncertainty, with definitive classification becoming possible only after resection. From a pragmatic perspective, this case also reinforces that ethanolamine can be considered when a severe solid thoracic lesion is progressing and advanced fetoscopic technology is unavailable or impractical.

Conclusion

Minimally invasive fetal intervention should be considered for severe thoracic lesions associated with hydrops when conservative management fails. In selected solid-appearing lesions, ultrasound-guided sclerotherapy offers a less invasive alternative to open fetal surgery, with potential maternal and fetal advantages. Based on the present case and reviewed literature, 5% monoethanolamine oleate appears to be a feasible, low-cost option, particularly in resource-limited settings, provided that meticulous Doppler-guided technique is used to minimize the risk of intravascular complications.

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Supplementary material 1. Search strategy

1) MEDLINE via PubMed: (("Congenital Pulmonary Airway Malformation"[MeSH] OR "Congenital Cystic Adenomatoid Malformation"[MeSH] OR CCAM[tiab] OR CPAM[tiab] OR "Pulmonary Sequestration"[MeSH] OR sequestration[tiab]) AND ("Fetal Therapy"[MeSH] OR "Prenatal Intervention"[MeSH] OR "Intrauterine Treatment"[tiab] OR "Minimally Invasive"[tiab] OR "Laser Ablation"[tiab] OR "Sclerotherapy"[tiab] OR "Radiofrequency"[tiab] OR "Percutaneous"[tiab]) AND (case[tiab] OR "case report"[Publication Type] OR "case series"[tiab]) NOT (animal[MeSH] OR placenta[tiab] OR newborn[tiab] OR postnatal[tiab]))

2) Embase: ('congenital pulmonary airway malformation'/exp OR 'congenital cystic adenomatoid malformation',ab OR CCAM,ab OR CPAM,ab OR 'lung sequestration'/exp OR 'pulmonary sequestration',ab OR sequestration,ab) AND ('fetal therapy'/exp OR 'fetal therapy',ab OR 'prenatal intervention',ab OR 'intrauterine treatment',ab OR 'minimally invasive',ab OR 'laser ablation',ab OR sclerotherapy,ab OR radiofrequency,ab OR

percutaneous,ab) AND (case,ab OR 'case report'/exp OR 'case report',ab OR 'case series',ab) NOT ('animal'/exp OR placenta,ab OR newborn,ab OR postnatal,ab)

3) LILACS via BVS: (("Congenital Pulmonary Airway Malformation" OR "Congenital Cystic Adenomatoid Malformation" OR "Malformação Congênita das Vias Aéreas Pulmonares" OR "Malformação Adenomatoide Cística Congênita" OR CCAM OR CPAM OR "Pulmonary Sequestration" OR "Sequestro Pulmonar" OR sequestration) AND ("Fetal Therapy" OR "Terapia Fetal" OR "Prenatal Intervention" OR "Intervenção Pré-Natal" OR "Intrauterine Treatment" OR "Tratamento Intrauterino" OR "Minimally Invasive" OR "Minimamente Invasivo" OR "Laser Ablation" OR "Ablação a Laser" OR Sclerotherapy OR Escleroterapia OR Radiofrequency OR Radiofrequência OR Percutaneous OR Percutâneo) AND (case OR "case report" OR "relato de caso" OR "case series" OR "série de casos")) NOT (animal OR animals OR placenta OR newborn OR "recém-nascido" OR postnatal OR "pós-natal")