Editorial

Fetoscopic Surgery: The Frontier of Maternal–Fetal Medicine in Indonesia

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Fetoscopic surgery represents one of the most transformative developments in modern maternal–fetal medicine. By allowing direct visualization and minimally invasive access to the intrauterine environment, fetoscopy bridges diagnostic precision with therapeutic intervention. Since its early applications in the 1990s, fetoscopic techniques have advanced significantly, improving both perinatal survival and long-term neurodevelopmental outcomes in fetuses affected by otherwise lethal conditions.[1-5] In Indonesia, the expansion of fetoscopic procedures marks a turning point in high-risk obstetric care, aligning with the global movement toward fetal precision medicine.[5,6]

Fetoscopy utilizes a minimally invasive endoscopic approach to access the amniotic cavity, enabling direct visualization of the fetus, umbilical cord, and placental surface. Depending on the indication, fetoscopic procedures can be classified as diagnostic or therapeutic, including fetoscopic laser photocoagulation for Twin-to-Twin Transfusion Syndrome (TTTS), fetoscopic tracheal occlusion for congenital diaphragmatic hernia (CDH), and fetoscopic repair of spina bifida.[4,5]

Fetoscopic surgery is performed under regional or general anesthesia, guided by ultrasound to identify placental location, cord insertion, and optimal entry points. A small trocar (2–4 mm) is inserted percutaneously into the recipient twin's amniotic sac, allowing introduction of a fetoscope equipped with fiber-optic illumination. The surgeon maps the vascular equator of the placenta and identifies arterio-venous, veno-venous, and arterio-arterial anastomoses. Laser photocoagulation is performed using selective or Solomon techniques to ablate abnormal vessels, followed by amniotic decompression to restore uterine tone. Postoperatively, patients are monitored for uterine activity, bleeding, and membrane integrity.[2,3,4]

Fetoscopic laser therapy has revolutionized TTTS management. The randomized trial by Senat et al. demonstrated superior perinatal survival and reduced neurological morbidity compared with serial amnioreduction.[2] Subsequent meta-analyses and randomized studies confirmed survival of at least one twin in approximately 80–90% of cases and dual survival rates of 60–70%.[3,4] Emerging fetoscopic techniques, including tracheal occlusion for CDH and minimally invasive neural tube defect repair, continue to expand the therapeutic horizon of fetal surgery.[5]

Fetoscopic interventions require multidisciplinary expertise and careful ethical deliberation. They balance maternal safety against fetal benefit under the principles of autonomy, beneficence, non-maleficence, and justice.[7,8] Challenges include informed consent, equitable access, training pathways, and cost, highlighting the need for structured fellowship programs and standardized credentialing in fetal therapy.[6-8]

Indonesia stands at the threshold of developing national fetal surgery capability. Several tertiary referral centers are poised to pioneer this field, supported by the establishment of a National Fetoscopy Network to harmonize referral pathways, procedural standards, and outcome registries, while international collaboration remains essential for accelerating expertise development.[5,6]

Beyond technical innovation, fetoscopic surgery must be interpreted within the continuum of maternal systemic, placental, and fetal biology. Adverse obstetric conditions such as preeclampsia in obese pregnancies are associated with dysregulated adipokine profiles, reflecting a complex metabolic–inflammatory milieu that may influence fetal vulnerability and procedural outcomes.[9] Maternal cardiovascular maladaptation, particularly in pregnancies complicated by hypertensive disorders and peripartum cardiomyopathy, further emphasizes the importance of comprehensive maternal risk

stratification when advanced fetal interventions are contemplated.[10] At the molecular level, hypoxia-related alterations in placental signaling pathways, including corticotrophin releasing hormone (CRH), CRH receptor-1, and connexin-43 expression, provide a biological framework linking intrauterine stress and the fetoscopic procedural environment.[11]

Fetoscopic surgery embodies the fusion of technology, ethics, and compassion. By treating the fetus as a patient within the womb, it redefines obstetric care and symbolizes Indonesia's commitment to advancing maternal–fetal health.[5,7,12]

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