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### Late onset growth restriction preceding stillbirth in India: Hadlock vs. GROW charts

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**Objective:** Stillbirth is strongly associated with small for gestational age (SGA) and fetal growth restriction (FGR), and timely antenatal recognition can lead to prevention. We investigated the commonly used Hadlock growth chart and a local population specific GROW standard in their ability to assess SGA related stillbirth risk in India.

**Design:** Retrospective cohort study

**Methods:** To investigate late onset FGR, we studied a 32+ week cohort of 67,808 births including 97 stillbirths delivered in a South Indian Tertiary Centre between 2015 and 2022. SGA was defined as less than 10th weight-for-gestational age centile at birth, and for stillbirths we corrected gestational age by deducting 2 days as the estimated average delay between fetal death and delivery in the third trimester. We applied two standards to determine SGA: 1. the widely used Hadlock charts for ultrasound estimated fetal weight, and 2. a fetal & neonatal standard derived from local population data of 48,683 low risk, normal outcome term pregnancies combined with the GROW proportionality curve (GROW-India). Relative risk (RR) and 95% confidence interval (CI) was calculated to assess the association between SGA and stillbirth using the two standards.

**Results:** According to the Hadlock standard, 21,184 of all births were SGA (31.2%) including 57 stillbirths, representing an RR of 3.14 (CI 2.10–4.71). With the GROW-India standard, 8,141 of births were SGA (12.0%) including 40 stillbirths (RR 5.74; CI 3.70–8.89). All but 17 stillbirths designated as SGA by Hadlock were identified also as SGA by GROW-India. The 17 additional stillbirths occurred among the 13,043 deliveries that were SGA only by Hadlock and not by GROW-India, with a non-significant RR of 1.52 (CI 0.86–2.68). Thus 61.6% (13,043/21,184) of the pregnancies designated as SGA only by Hadlock did not have an increased stillbirth risk.

**Conclusion:** Compared to the locally derived GROW-India fetal & neonatal standard, the Hadlock growth chart leads to substantial overdiagnosis of SGA in Indian pregnancies that are not at increased risk of stillbirth.