Dear Members of the Working Group:

We would like you again for participating in the second meeting of the SOON Consensus Working Group on Fetal Growth and contributing your time and experience to the standardization of fetal growth assessment in our obstetrical network.

A total of 24 individuals participated in the meeting: 20 in person and 4 via video-conference. The list of participants appears below (***Table 1***).

**A. MEETING MINUTES**

1. **General Introduction / Jon Barrett**

2. **Purpose of meeting / Nir Melamed** (See attached presentation [***Melamed - Introduction]***)

* Rationale and importance of standardization of fetal growth assessment
* Summary of consensus recommendations from the 1st meeting
* Variation in growth assessment in SOON (***Tables 2.1, 2.2, 2.3, and 2.4*** below)
* Strategy for achieving consensus
* Strategies for knowledge translation

3. **Review of dating and percentile charts, and their performance in our local population / Nir Melamed and Vasi Stratulat** (See attached presentation [***Melamed-Stratulat-Review of Charts***])

* 3.1) 1st trimester dating
	+ Reviewed available charts
	+ Performance of the various charts was compared using data from 1,136 NT scans in low-risk women
	+ For CRL – the chart of **Daya 93’** performed best
	+ For BPD – the chart of **Hadlock 82’** performed best (while the chart of **Hadlock 84’** was associated with a systematic over-estimation of gestational age by 7 days)
	+ **A consensus decision was made to adapt the Daya 93’ chart for CRL and the Hadlock 82’ chart for dating using BPD during the 1st trimester (see summary below)**
* 3.2) 2nd and 3rd trimester dating
	+ Reviewed available charts
	+ Performance of the various charts was compared using data from 1,984 scans in low-risk women from Sunnybrook and MSH
	+ The following charts were found to perform best for dating during the 2nd and 3rd trimester:
		- BPD: **Hadlock 82’**
		- HC: **Hadlock 84’**
		- AC: **Hadlock 82’**
		- FL: **Hadlock 84’**
	+ **A consensus decision was made to the charts described above for dating during the 2nd and 3rd trimester (see summary below)**
* 3.3) Charts for Growth Percentiles
	+ Reviewed available charts
	+ Performance of the various charts was compared using data from 1,984 scans in low-risk women from Sunnybrook and MSH
	+ The following charts were found to perform best for determining percentiles of fetal biometry:
		- BPD: **Hadlock 82’**
		- HC: **Hadlock 84’**
		- AC: **Hadlock 82’**
		- FL: **Hadlock 84’**
	+ **A consensus decision was made to the charts described above for dating during the 2nd and 3rd trimester (see summary below)**
* 3.4) How to determine Average Ultrasound Age (AUA)
	+ Performance of 4 approaches (simple average vs. multiparameter Hadlock equation, with vs. without BPD) was compared various charts using data from 1,984 scans in low-risk women from Sunnybrook and MSH
	+ A simple mean of the gestational weeks corresponding to HC, AC, and FL (without BPD) was found to be superior to the other approaches.
	+ **A consensus decision was made to calculate the AUA using a simple average of the weeks calculated for HC, AC, and FL (see summary below)**
* 3.5) How to present indices in the ultrasound report
	+ We reviewed the rationale of expressing biometric indices as percentiles, weeks, or both.
	+ **A consensus decision was made present biometric indices using both percentiles and weeks**

4. **When to suspect a short femur length / Phyllis Glanc** (See attached presentation [***Glanc – Short Femur***])

* Review of the clinical associations of short femur
* It was emphasized that in cases of skeletal dysplasia, the magnitude of shortening is expected to be at least 4 standard deviations below the mean (Z-score <-4)
* Discussion of the approach for short femur length at mid second trimester scan
* Consideration that published data to date relates primarily to retrospective data
* Presentation of a proposed protocol

5. **When to suspect a small or large head / Ants Toi** (See attached presentation [***Toi – SmallLargeHead***])

* Review of the challenges in the diagnosis of microcephaly
* Common definitions used for the antenatal and postnatal diagnosis of microcephaly
* Impact of the choice of chart for HC on the risk of microcephaly
* **It was recommended that when HC is <5th percentile 🡪 include in the report also the Z-score for HC (using Chervenak's reference which has been best validated against outcomes related to microcephaly) to provide an indication of how low below the 5th% the HC is *(Table 3 below)*.**

**B. CONSENSUS DECISIONS**

|  |  |  |  |
| --- | --- | --- | --- |
| **Decision** **#:** | **Topic** | **Decision** | **Rationale** |
| (1) | CRL chart for dating (1st trimester) | Daya 93’:***GA (days) = 40.447 + 1.125\*CRL -0.0058\*CRL2 [see attached reference ‘Daya AJOG 1993’]*** | * Only chart that is based on IVF
* Canadian
* Best performance in our population
* Most commonly used chart in SOON
 |
| (2) | BPD chart for dating (throughout gestation) | Hadlock 82’:***GA (weeks) = 6.8954 + 2.6345xBPD + 0.00877\*BPD3 [see attached reference ‘Hadlock BPD JUM 1982’]*** | * Best performance in our population (Hadlock 84’ results in systematic over-estimation of GA by 7 days in the 1st trimester
* Most commonly used chart in SOON
 |
| (3) | HC chart for dating (throughout gestation) | Hadlock 84’:***GA (weeks) = 8.96 + 0.54\*HC + 0.0003\*HC3[see attached reference ‘Hadlock Radiology 1984’]*** | * Best performance in our population
 |
| (4) | AC chart for dating (throughout gestation) | Hadlock 82’:***GA (weeks) = 7.607 + 0.7645\*AC + 0.00393\*AC2[see attached reference ’Hadlock AC AJR 1982’]*** | * Best performance in our population
* Most commonly used chart in SOON
 |
| (5) | FL chart for dating (throughout gestation) | Hadlock 84’:***GA (weeks) = 10.35 + 2.46\*FL + 0.17\*FL2[see attached reference ‘Hadlock Radiology 1984’]*** | * Best performance in our population
 |
| (6) | Chart for BPD percentile | Hadlock 82’:***Mean BPD (cm) = - 2.34 + 0.367\*GA - 0.0000449\*GA3; SD=0.2 cm [see attached reference ‘Hadlock BPD JUM 1982’]*** | * Best performance in our population
* Most commonly used chart in SOON
 |
| (7) | Chart for HC percentile | Hadlock 84’:***Mean HC (cm) = -11.48 + 1.56\*GA - 0.0002548\*GA3; SD=1.0 cm[see attached reference ‘Hadlock Radiology 1984’]*** | * Best performance in our population
 |
| (8) | Chart for AC percentile | Hadlock 82’:***Mean AC (cm) = -10.4997 + 1.4256\*GA -0.00697\*GA2; SD=1.23 cm[see attached reference ‘Hadlock AC AJR 1982’]*** | * Best performance in our population
* Most commonly used chart in SOON
 |
| (9) | Chart for FL percentile | Hadlock 84’:***Mean FL (cm) = -3.91 + 0.427\*GA – 0.0034\*GA2; SD=0.3 cm[see attached reference ‘Hadlock Radiology 1984’]*** | * Best performance in our population
 |
| (10) | Calculation of Average Ultrasound Age (AUA) | ***Simple average of the weeks calculated for HC, AC, and FL*** | * Best performance in our population
 |
| (11) | How to present indices in the ultrasound report | * Present as both **WEEKS** and **PERCENTILES**
 | * Percentiles - more precise, GA independent, more likely to capture attention
* Weeks – easier in early gestation, can assist when comparing serial exams, some care providers may be used to weeks
 |
|  |  | When **HC<5th%,** include in the report also the **Z-score for HC** (using Chervenak's reference – see attached ‘**Chervenak HC AJOG 1984’**) - ***(Table 3 below)*** | * Provides an indication of how low below the 5th% the HC is
* Definition of microcephaly is based on Z-score
 |

**C. NEXT STEPS**

1. **Present the Consensus decisions in the upcoming SOON meeting**
2. **Write and submit a paper to JOGC describing the approach towards consensus and a summary of the consensus decisions**

**If any of you is interested in leading the next meeting or would like to discuss ideas for discussion in the next meeting please contact:
Nir (****nir.melamed@sunnybrook.ca****) or Jon (****Jon.barrett@sunnybrook.ca****)**

**D. TABLES**

**Table 1: Participants in the first consensus meeting, Nov-12th, 2019**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| # | **Name** | **Speciality** | **Centre** | **In person** | **Teleconference** |
| 1 | Jon Barrett | MFM | Sunnybrook | X |   |
| 2 | Nir Melamed | MFM | Sunnybrook | X |   |
| 3 | Ori Nevo | MFM | Sunnybrook | X |   |
| 4 | Phyllis Glanc | Rad | Sunnybrook | X |   |
| 5 | Vasilica Stratulat | U/S | Sunnybrook | X |   |
| 6 | Howard Berger | MFM | SMH | X |   |
| 7 | John Kingdom | MFM | MSH |  |  |
| 8 | Nan Okun | MFM | MSH | X |   |
| 9 | Nimrah abassi | MFM | MSH | X |   |
| 10 | Clare Whitehead | MFM | Australlia |  | X |
| 11 | Ants Toi | Rad | MSH | X |   |
| 12 | Patrick Mohide | MFM | McMaster |   |  |
| 13 | Bryon DeFrance | MFM | McMaster |   | X |
| 14 | Elad Mei-Dan | MFM | NYGH | X |   |
| 15 | Hani Akoury | MFM | St Joseph's | X |   |
| 16 | Rose Rahmani | Rad | RR Imaging |   |  |
| 17 | Rose Lee | Rad | True North | X |   |
| 18 |  Sharon Shin | Rad | True North | X |   |
| 19 | Bonnie O'hayon | Rad | NYGH | X |  |
| 20 | Karolyn Zareetsky | Rad | Port Perry Imaging |  | X |
| 21 | Amir aviram |  FMM Fellow | MSH | X |  |
| 22 | Liran Hiersch |  FMM Fellow | MSH | X |  |
| 23 | Mickey Zhang  | MFM | Markham |  | X |
| 24 | Lara Gotha | MFM | Scarborough  | X |  |
| 25 | Richard Persadie | MFM | McMaster |  |  |

**TABLE 2.1: Variation in charts used for ultrasound dating in SOON**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Center**  | **CRL**  | **BPD** | **HC** | **AC** | **FL** |
| Sunnybrook  | **Daya 93**  | **Hadlock 82/84**  | **Hadlock 82/84**  | **Hadlock 82/84**  | **Hadlock 84**  |
| MSH (CEOU)  | **Daya 93**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Jeanty 84**  |
| St Jose Hospital (Toronto)  | **Daya 93**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  |
| SMH  | **Hadlock 92**  | **Hadlock 84**  | **Hadlock 84**  | **Hadlock 84**  | **Hadlock 84**  |
| True North Imaging  | **Hadlock 92**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  |
| St Joseph’s (Hamilton) | **Daya 93**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  |
| MUMC  | **Daya 93**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  |
| NYGH  | **Hadlock 92**  | **Hadlock 84**  | **Hadlock 84**  | **Hadlock 84**  | **Hadlock 84**  |
| RR Imaging | **Robinson 75**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 84**  | **Jeanty 84**  |
| Port Perry  | **Daya 93**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Jeanty**  |
| MSH (Fetal Unit)  | **Robinson 75**  | **Chitty 94**  | **Verburg 08?**  | **Verburg 08?**  | **Verburg 08?**  |
| Credit Valley  | **?**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  |

**TABLE 2.2: Variation in the approach used to calculate overall dating (AUA) in SOON**

|  |  |
| --- | --- |
| **Center**  | **Approach to determine AUA** |
| Sunnybrook  | **Simple average** BDP+HC+AC+FL  |
| MSH (CEOU)  | **Simple average** cBDP+AC+FL  |
| St Jose Hospital (Toronto)  | **Multiparameter Hadlock equation**  |
| SMH  | **Simple average** HC, AC, FL  |
| True North Imaging  | **Multiparameter Hadlock equation**  |
| St Joseph’s (Hamilton) | **Multiparameter Hadlock equation** (after CRL>84mm and up to 22-24 weeks, for EDC estimation only)  |
| MUMC  | Other: SOGC recommendation Feb 2014  |
| NYGH  | **Multiparameter Hadlock equation**  |
| RR Imaging | **Multiparameter Hadlock equation**  |
| Port Perry  | BPD is no longer used to calculate EFW (as per  2019 SOON consensus meeting)  |
| MSH (Fetal Unit)  | **Multiparameter Hadlock equation**  |
| Credit Valley  | **Simple average** BDP+HC+AC+FL  |

**TABLE 2.3: Variation in charts used to determine growth percentiles of fetal biometry in SOON**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Center**  | **BPD** | **HC** | **AC** | **FL** |
| Sunnybrook  | **Hadlock 82/84**  | **Hadlock 82/84**  | **Hadlock 82/84**  | **Hadlock 84**  |
| MSH (CEOU)  | **Hadlock 82**  | **Hadlock82**  | **Hadlock 82**  | **Jeanty 84**  |
| St Jose Hospital (Toronto)  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Jeanty 84**  |
| SMH  | **Hadlock 84**  | **Hadlock 84**  | **Hadlock 84**  | **Hadlock 84**  |
| True North Imaging  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  |
| St Joseph’s (Hamilton) | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  |
| MUMC  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Jeanty 84**  |
| NYGH  | **Hadlock 84**  | **Hadlock 84**  | **Hadlock 84**  | **Hadlock 84**  |
| RR Imaging | **Hadlock 84**  | **Hadlock 84**  | **Hadlock 84**  | **Jeanty 84**  |
| Port Perry  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  |
| MSH (Fetal Unit)  | **Chitty 94**  | **Verburg 08**  | **Verburg 08**  | **Verburg 08**  |
| Credit Valley  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  | **Hadlock 82**  |

**TABLE 2.4: Variation in how biometric indices are expressed the ultrasound reports in SOON**

|  |  |
| --- | --- |
| **Center**  | **Approach to determine AUA** |
| Sunnybrook  | **Weeks** (+**centile** when abnormal)  |
| MSH (CEOU)  | **Weeks**  |
| St Jose Hospital (Toronto)  | **Weeks**  |
| SMH  | **Weeks + centile**  |
| True North Imaging  | **Weeks** (+**centile** when abnormal)  |
| St Joseph’s (Hamilton) | (a) **Centile** after 22 weeks and dates and EDC confirmed (b) **weeks** prior to 20 weeks  |
| MUMC  | **Centile**  |
| NYGH  | **Weeks + centile**  |
| RR Imaging | **Weeks + centile**  |
| Port Perry  | **Weeks**  |
| MSH (Fetal Unit)  | **Centile (weeks for T1)**  |
| Credit Valley  | **Weeks**  |

**TABLE 3: Mean and SDs of head perimeter as a function of gestational age – Chervenak et al, AJOG 1984, Vol 9, 5:512-517**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Week | +2SD | +1SD | Mean | **-1SD** | **-2SD** | **-3SD** | -4SD | -5SD |
| 20 | 204 | 189 | 175 | **160** | **145** | **131** | 116 | 101 |
| 21 | 216 | 201 | 187 | **172** | **157** | **143** | 128 | 113 |
| 22 | 228 | 213 | 198 | **184** | **169** | **154** | 140 | 125 |
| 23 | 239 | 224 | 210 | **195** | **180** | **166** | 151 | 136 |
| 24 | 250 | 235 | 221 | **206** | **191** | **177** | 162 | 147 |
| 25 | 261 | 246 | 232 | **217** | **202** | **188** | 173 | 158 |
| 26 | 271 | 257 | 242 | **227** | **213** | **198** | 183 | 169 |
| 27 | 282 | 267 | 252 | **238** | **223** | **208** | 194 | 179 |
| 28 | 291 | 277 | 262 | **247** | **233** | **218** | 203 | 189 |
| 29 | 301 | 286 | 271 | **257** | **242** | **227** | 213 | 198 |
| 30 | 310 | 295 | 281 | **266** | **251** | **236** | 222 | 207 |
| 31 | 318 | 304 | 289 | **274** | **260** | **245** | 230 | 216 |
| 32 | 327 | 312 | 297 | **283** | **268** | **253** | 239 | 224 |
| 33 | 334 | 320 | 305 | **290** | **276** | **261** | 246 | 232 |
| 34 | 341 | 327 | 312 | **297** | **283** | **268** | 253 | 239 |
| 35 | 348 | 333 | 319 | **304** | **289** | **275** | 260 | 245 |
| 36 | 354 | 339 | 325 | **310** | **295** | **281** | 266 | 251 |
| 37 | 360 | 345 | 330 | **316** | **301** | **286** | 272 | 257 |
| 38 | 364 | 350 | 335 | **320** | **306** | **291** | 276 | 262 |
| 39 | 369 | 354 | 339 | **325** | **310** | **295** | 281 | 266 |
| 40 | 372 | 358 | 343 | **328** | **314** | **299** | 284 | 270 |
| 41 | 375 | 360 | 346 | **331** | **316** | **302** | 287 | 272 |
| 42 | 377 | 363 | 348 | **333** | **319** | **304** | 289 | 275 |