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## Does Swaddling Influence Developmental Dysplasia of the Hip?

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THERE has been a recent trend toward swaddling to help decrease crying and promote uninterrupted sleep in neonates.<sup>1</sup> Substantial anecdotal evidence has been supportive of this technique. Most studies have found that swaddling does decrease crying and promote sleep in the very young,<sup>2-5</sup> but another study found that it made no difference.<sup>6</sup> Swaddling is recognized to be an age-old technique; however, Dr Harvey Karp<sup>1</sup> recently increased its popularity in the United States with a popular book and promotion program. As pediatricians increasingly recommend swaddling of neonates to decrease crying and promote sleep, there is concern in both the pediatric and pediatric orthopedic communities that it may influence the rate of developmental dysplasia of the hip (DDH) in this population.

DDH is considered to be one of the most common congenital defects.<sup>7</sup> There is currently some ongoing debate about whether to screen for hip dysplasia,<sup>8-11</sup> because most hip dysplasia present in the first few days of life resolves on its own untreated.<sup>7-9</sup> Nonetheless, even those who do not advocate for screening recognize that hip dysplasia can lead to premature degenerative joint disease and chronic pain.<sup>9</sup> DDH is considered to be one of the leading causes of early arthritis of the hip.<sup>12</sup> Increasing the rate of hip dysplasia in the neonate would lead to increased rates of early arthritis in young adults.

Swaddling has been recognized to be a risk factor for DDH.<sup>11,13-15</sup> In randomized clinical trials that have compared crying rates of swaddled and unswaddled infants, newborns considered to be at risk for DDH were excluded.<sup>5,6</sup> Several studies have found a history of swaddling to be one of several risk factors for DDH<sup>16-18</sup> in addition to the well-known risk factors of breech delivery and family history. For certain cultures in which swaddling has been especially prevalent, a higher rate of DDH has been observed, including in Saudi Arabia,<sup>18</sup> Japan,<sup>15,19</sup> Turkey,<sup>13</sup> and the Navajo Indian.<sup>20-22</sup> Although it is not clear if this is a result of ethnic variations in DDH or a result of the swaddling technique, a population-wide program to decrease swaddling and promote wide diapers has been shown to decrease the rate of DDH. In Japan, a nationwide program to avoid prolonged extension of the hips and knees in swaddling resulted in a more than fivefold reduction in the rate of DDH.<sup>15,19</sup>

However, no study has directly compared the rates of DDH in swaddled and unswaddled infants. Such a study would have to be large. Given a rate of DDH by ultrasound of 25 of 1000 infants,<sup>8,11</sup> to show an increase of DDH in swaddled infants to 50 of 1000 (twice the rate) with a *P* value of 5% and a power of 80%, 2000 infants would need to be randomly assigned.<sup>23</sup> A more modest increase in DDH as a result of swaddling would take many more in the study. However, even this more modest increase in the individual risk of DDH on a population level would result in thousands of cases of early hip arthritis.

Swaddling, as asserted by Karp, is effective because it mimics "the snugness of the womb" and limits the Moro reflex, which can wake and aggravate an infant.<sup>1</sup> Although this has not been proven as the mechanism, swaddling has been shown to prolong sleep in healthy infants.<sup>2,4,14</sup> The swaddling technique focuses on having the arms bound by the sides of the body so that they cannot wriggle free. However, even Karp notes that "infants swaddled with their arms down still have lots of flexion in their legs. . . ."<sup>1</sup> Studies have shown effective swaddling technique while allowing flexion and abduction of the hips.<sup>14</sup> Allowing even tightly swaddled infants to still have this flexion and abduction in their hips would allow for safe development of their hips.

At birth, prospective ultrasound evaluation has shown that ~17% of infant hips show some dysplasia, or immaturity.<sup>24</sup> Although most of this resolves untreated,<sup>7-9,24</sup> these infants may be especially susceptible to persistent dysplasia if the hips are not kept in an optimal position. Studies have shown that keeping the hips extended and adducted promotes dysplasia,<sup>13,19,20</sup> and less DDH may resolve untreated if these hips are

**Abbreviation:** DDH, developmental dysplasia of the hip

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held in that position. Furthermore, neonatal hips that initially had a normal physical examination have been shown after swaddling to produce a “hip click.”<sup>15</sup> There have been reported cases of DDH appearing after a few months even in infants who had normal ultrasound findings at birth.<sup>19,24,25</sup> The increase in DDH as a result of swaddling would not be seen in the newborn infant but would appear later in the neonate or persist as a result of unresolved dysplasia. Physical examination screening with Ortolani and Barlow examinations (the classic hip click) may or may not detect all infants with DDH,<sup>7</sup> and infants who are persistently swaddled may be considered for ultrasound screening. Infants who have other risk factors for hip dysplasia, notably family history of DDH or breech position in utero, would be at an especially high risk for worsening DDH as a result of swaddling.

Although we appreciate that swaddling may sometimes be an effective technique to decrease crying and promote sleep in newborns, there is concern that it may lead to an increase in hip dysplasia. Pediatricians who are taking care of these neonates should be aware that swaddling has been found to be a risk factor for DDH. When examining these infants for clinical screening of DDH, there should be heightened awareness when performing the Ortolani and Barlow (hip click) examinations in swaddled infants because of the increased risk. This increase in DDH would likely occur in older neonates rather than newborns. For infants who are already at increased risk for DDH because of family history or breech delivery, hip ultrasound screening should be performed as recommended by the American Academy of Pediatrics clinical practice guidelines<sup>11</sup>; if dysplasia is found, swaddling should be avoided. If the screening ultrasound findings are normal, then swaddling can be safely allowed. For all infants who are swaddled, monitoring of the swaddling technique to ensure that their hips are allowed to flex and abduct in a safe position for hip development may lessen the risk of DDH.

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