INFLUENCE OF MATERNAL SIZE AND PARITY ON ONSET OF LABOUR IN MULTIPLE PREGNANCY IN MAN

BY T. McKEOWN AND R. G. RECORD

From the Department of Social Medicine, University of Birmingham

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SUMMARY

The association between duration of gestation and (a) parental height, and (b) mother’s parity is examined in 1028 single and 375 twin maternities. With increasing height of mother, duration of gestation increases in multiple pregnancy; the two variables are unrelated in single pregnancy. With increasing parity, duration of gestation increases in multiple pregnancy and decreases slightly in single pregnancy. It is suggested that these observations provide support for the view that the early onset of labour in multiple pregnancy may be due to the size of the foetuses.

It is well recognized that in some species association between birth weight and litter size is attributable in part to short gestation of large litters. This is the case in man, and in a previous communication in this journal [McKeown & Record, 1952] it was suggested that the early onset of labour in multiple pregnancy may be due to the fact that the foetuses become too large for the uterus. No direct support for this view was available; indeed it was noted that at birth litter weight is not the same for twins, triplets and quadruplets (as might have been expected if size were the only influence which determines onset of labour). But mean duration of gestation was also related to litter size, and it was suggested that time of onset of labour may be determined by the relation between total foetal weight and the tolerance of the uterus at any given period of gestation.

In the present communication it is shown that in twin pregnancy, unlike single pregnancy, duration of gestation is related both to the size of the mother (as indicated by her height) and to her parity. Reasons are suggested for believing that these observations support the view that in multiple pregnancy the early onset of labour is due to the size of the foetuses.

MATERIAL

(a) Single births

Observations were made in respect of 1028 births (selected from 1289 single births in the County Borough of Smethwick between 1 April 1949 and 31 March 1950). Data recorded are birth weight, heights of both parents, parity (the number of pregnancies resulting in live-births or still-births), sex, and duration of gestation (recorded as the period between the 1st day of the last menstrual period preceding pregnancy, and the day of delivery).

(b) Twins

Birth weight, parity, sex and duration of gestation were recorded in respect of 375 twin births, selected from 1129 recorded in six Birmingham maternity hospitals. Heights of parents of 406 pairs were measured, but thirty-one had to be excluded because one or both foetuses were stillborn.
ONSET OF LABOUR IN MULTIPLE PREGNANCY

RESULTS

Gestation according to parity

In single pregnancy there is a small negative correlation between length of gestation and maternal age and parity [Karn & Penrose, 1951]. But the association with age disappears when length of cycle is fixed [Gibson & Dougray, 1953], which suggests that it is the interval between onset of menstruation and ovulation which decreases slightly with age, rather than the period between ovulation and birth. This interpretation is consistent with reports that length of cycle is negatively correlated with age [Gunn, Jenkin & Gunn, 1937; McKeown, Gibson & Dougray, 1954]. The association between gestation and parity is, however, independent of both length of cycle and maternal age [Gibson & Dougray, 1953] which suggests that in single pregnancy the period between ovulation and birth decreases slightly with increasing parity.

In a previous discussion of onset of labour in multiple pregnancy [McKeown & Record, 1952] it was stated that there is little evidence of change in mean duration of gestation with birth rank. Although possibly not misleading in the context in which it was then discussed, this statement is not strictly correct. Table 1 gives the relevant data derived from the earlier inquiry and the mean duration of gestation for first and later born twins in the present series. For each size of litter duration of gestation is greater for later born than for first born; the difference in the present series of twins is 5.0 ± 2.0 days.

Table 1. Mean duration of gestation according to parity

<table>
<thead>
<tr>
<th></th>
<th>First born</th>
<th>Later born</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of litters*</td>
<td>Mean gestation (days)</td>
</tr>
<tr>
<td>Triplets (McKeown &amp; Record [1952])</td>
<td>68</td>
<td>246.1</td>
</tr>
<tr>
<td>Twins (McKeown &amp; Record [1952])</td>
<td>70</td>
<td>259.2</td>
</tr>
<tr>
<td>Twins (present series)</td>
<td>117</td>
<td>260.6</td>
</tr>
</tbody>
</table>

* The use of the term 'litter' in connexion with the number of human births may be considered undesirable, but there appears to be no more satisfactory alternative when multiple births include triplets, as well as twins.

Gestation according to parental height

Table 2 relates gestation to parental height. For twins mean duration of gestation increases with increasing height of mother; there is no regular association between gestation and height of father. In the case of single births, mean duration of gestation is unrelated to mother's height; it appears to increase very slightly with father's height, but it is hard to believe that these variables are correlated.

It will be noted that both mean weight of single births and mean litter weight of twins increase fairly sharply with increasing height of mother; association of birth weight with height of father is much less marked in singletons, and is absent in twins. These results are consistent with observations on the horse [Walton & Hammond, 1938]; they are discussed more fully elsewhere [Cawley, McKeown & Record, 1954].

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In Table 3 mean duration of gestation according to maternal height is given separately for first and later born. In twins this treatment sharpens the association of gestation with both height and parity of the mother; in singletons it has little influence on the irregular association between gestation and mother's height, but the decrease in mean duration of gestation with increasing parity is exhibited in each maternal height group. A regular increase in foetal weight with mother's height and parity is shown by both twins and singletons.

Table 2. Mean duration of gestation according to parental height

<table>
<thead>
<tr>
<th>Height of mothers (in.)</th>
<th>Twins</th>
<th></th>
<th>Singletons</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Mean</td>
<td>No.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>gestation</td>
<td>weight</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(days)</td>
<td>of pair</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 62</td>
<td>96</td>
<td>262-1</td>
<td>10-71</td>
<td>167</td>
</tr>
<tr>
<td>62-</td>
<td>133</td>
<td>264-0</td>
<td>11-07</td>
<td>275</td>
</tr>
<tr>
<td>64-</td>
<td>90</td>
<td>264-7</td>
<td>11-29</td>
<td>347</td>
</tr>
<tr>
<td>66 and over</td>
<td>56</td>
<td>266-1</td>
<td>12-20</td>
<td>299</td>
</tr>
<tr>
<td>Height of fathers (in.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 66</td>
<td>77</td>
<td>261-9</td>
<td>11-15</td>
<td>175</td>
</tr>
<tr>
<td>66-</td>
<td>96</td>
<td>266-1</td>
<td>11-14</td>
<td>236</td>
</tr>
<tr>
<td>68-</td>
<td>88</td>
<td>263-8</td>
<td>11-31</td>
<td>233</td>
</tr>
<tr>
<td>70 and over</td>
<td>114</td>
<td>263-9</td>
<td>11-20</td>
<td>384</td>
</tr>
<tr>
<td>Total</td>
<td>375</td>
<td>264-0</td>
<td>11-20</td>
<td>1028</td>
</tr>
</tbody>
</table>

Table 3. Mean duration of gestation according to maternal height and parity

<table>
<thead>
<tr>
<th>Height of mothers (in.)</th>
<th>First born</th>
<th></th>
<th>Later born</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Mean</td>
<td>No.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>gestation</td>
<td>weight*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(days)</td>
<td>(lb.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 62</td>
<td>19</td>
<td>256-5</td>
<td>9-28</td>
<td>77</td>
</tr>
<tr>
<td>62-</td>
<td>40</td>
<td>259-3</td>
<td>10-06</td>
<td>93</td>
</tr>
<tr>
<td>64-</td>
<td>31</td>
<td>260-7</td>
<td>10-73</td>
<td>59</td>
</tr>
<tr>
<td>66 and over</td>
<td>27</td>
<td>265-1</td>
<td>11-23</td>
<td>29</td>
</tr>
<tr>
<td>Twins</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under 62</td>
<td>72</td>
<td>280-0</td>
<td>6-60</td>
<td>95</td>
</tr>
<tr>
<td>62-</td>
<td>115</td>
<td>281-6</td>
<td>7-22</td>
<td>160</td>
</tr>
<tr>
<td>64-</td>
<td>161</td>
<td>281-4</td>
<td>7-16</td>
<td>186</td>
</tr>
<tr>
<td>66 and over</td>
<td>68</td>
<td>281-5</td>
<td>7-54</td>
<td>171</td>
</tr>
<tr>
<td>Singletons</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Mean weight of pair in case of twins.

These results indicate that while the influence of maternal height and parity on foetal weight is similar in single and twin pregnancy, their influence on duration of gestation is different in the two cases. For twins, gestation increases with mother's height and parity; for singletons, gestation is not consistently related to mother's height, and decreases with parity.

DISCUSSION

There is a good deal of evidence (reviewed by Reynolds [1949]) that in most species, including man, onset of labour cannot normally be attributed to any single cause. But in human multiple pregnancy the short duration of gestation, and the fact that
most foetuses are delivered before they are mature, suggest that labour occurs before
the normal mechanism has had time to operate. It seems possible that in multiple
pregnancy onset of labour is frequently due to a single cause, and we have explored
the most obvious one, namely, that labour begins because the foetuses become too
large for the uterus. This explanation is obviously unacceptable in single pregnancy
in man, since single births are delivered at a mean weight well below mean litter
weights accommodated in multiple pregnancy; it is equally unacceptable in such
species as the rat and monkey, in which onset of labour appears to be independent of
litter weight, the placentae being delivered after a gestation of normal length if the
foetuses are removed in mid-pregnancy [Klein, 1933, 1935; Newton, 1935; Selye,
Collip & Thomson, 1935; Kirsch, 1938; van Wagenen & Newton, 1943].

The observation [McKeown & Record, 1952] that twins, triplets and quadruplets
were delivered at different litter weights (10.53, 12.00 and 12.28 lb, respectively) may
at first sight appear inconsistent with the view that weight of foetus determines
onset of labour. But it must be remembered that these litter weights were reached
at different stages of gestation (261.6, 246.8 and 236.8 days respectively), and it
seems reasonable to expect that if labour begins because the foetuses become too
large, the weight of foetus which the uterus will tolerate would decrease as pregnancy
advances.

The association between duration of gestation and maternal height provides some
support for these views. In single pregnancy, where foetal weight has little influence
on time of onset of labour, duration of gestation is unrelated to mother's height.
But in twin pregnancy, where it is suggested that foetal weight may determine
onset of labour, duration of gestation increases with increasing height of the mother
(which may presumably be regarded as a general indication of maternal size).
The association between gestation and mother's height is particularly marked in
first born.

It has also been noted that in multiple pregnancy duration of gestation increases
with parity (Tables 1 and 3), whereas in single pregnancy there is a negative corre-
lation between the two variables (Table 3). It is tempting to regard this as further
evidence of the influence of weight on onset of labour in multiple pregnancy (on the
grounds that a greater litter weight can be tolerated in later than in first pregnancies).
But before accepting this view we should consider the possibility that the shorter
gestation of first-born twins is due to a higher incidence of hydramnios, an expla-
nation suggested by: (a) the common belief that incidence of hydramnios is greater in
monozygous than in dizygous twins [Strachan, 1947; Baird, 1950; Browne, 1951],
a belief not supported, it may be noted, by data of Guttmacher [1939]; and (b) the
observation that the proportion of monozygous twins may be higher among first
than among later born [Yerushalmy & Sheerar, 1940]. That this explanation is un-
acceptable is suggested by the fact that the association between parity and duration
of gestation appears to be independent of zygosity: for twins of unlike sex (all of
which are dizygous) mean lengths of gestation of first and later born are respectively
257.7 and 269.0 days (difference: 11.3 ± 3.7).

It is concluded that increasing parity as well as size of mother enable twin
pregnancies to continue longer; the same variables have little influence on the
duration of single pregnancies.
In general the association between birth weight and parental height in man (Table 2) is the same as that reported by Walton & Hammond [1938] in the horse; by crossing Shire and Shetland breeds they showed that weight of foal at birth was more highly correlated with weight of dam than with weight of sire. This result must have been due to a difference in rate of foetal growth according to maternal size, for differences in length of gestation were trivial.

Observations in single pregnancy in man are entirely consistent with this: length of gestation appears to be unrelated to height of mother (Table 2), and the positive correlation between birth weight and height of mother must be attributed wholly to variation in the rate of prenatal growth. In twin pregnancy, birth weight is again correlated with maternal height; but in this case length of gestation increases quite sharply with maternal height. Nevertheless, in twin pregnancy also, the association between litter weight and mother’s height is mainly due to variation in the rate of foetal growth, as can readily be shown by examining the correlation between these two variables when duration of gestation is fixed [McKeown & Record, 1954].

We acknowledge our indebtedness to the staffs of Birmingham hospitals for permission to use hospital records. The heights of parents were measured by Miss Ida Giles and Miss Lorna Round. The research was assisted by a grant from the Birmingham University Students’ Social Services Fund.

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McKeown, T. & Record, R. G. [1952]. *J. Endocrin.* 8, 386.
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