Mode of delivery in non-cephalic presenting twins: a systematic review

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Abstract

Purpose This systematic review aims to determine if there are evidence-based recommendations for the optimal mode of delivery for non-cephalic presenting first- and/or second twins. We investigated the impact of the mode of delivery on neonatal outcome for twin deliveries with (1) the first twin (twin A) in non-cephalic presentation, (2) the second (twin B) in non-cephalic presentation and (3) both twins in non-cephalic presentation.

Methods A computer-aided search of Medline, Embase, Cinahl and Cochrane databases was carried out and quality of the studies was assessed with the Cochrane Collaboration’s tool for assessing risk of bias and the GRADE approach.

Results One high-quality clinical trial (60 twin pairs) and 16 moderate/low-quality observational studies (3,167 twin pairs) showed no difference in neonatal outcome between vaginal and caesarean delivery in twin A and/or B.

Conclusion Our results do not suggest benefit of caesarean over vaginal delivery for selected twin gestations with twin A and/or twin B in non-cephalic presentation. However, no final conclusion can be drawn due to the small sample sizes and statistic limitations of the included studies. Randomized studies with sufficient power are required to make a strong recommendation.

Keywords Twins · Non-cephalic presentation · Mode of delivery · Systematic review

Introduction

The incidence of twin pregnancy has increased largely because of the proliferation of assisted reproductive technologies and the rise in maternal age [1]. Twin gestations comprise approximately 1% of all pregnancies but account for nearly 10% of perinatal mortality [2, 3]. The increased morbidity and mortality of twin gestations is frequently attributed to preterm birth, intrauterine growth restriction and other unique complications of twin gestations such as twin–twin transfusion syndrome [4]. Hazards of twin delivery can be attributed to non-cephalic presentation as well [5]. Non-cephalic presentation of the first twin (twin A), the second twin (twin B) or both twins occurs in about 60% of all twin pregnancies [2, 4, 5].

No consensus about the appropriate mode of delivery for non-cephalic presenting twins exists [6, 7]. Neither the practice bulletin on multiple gestation of the American College of Obstetricians and Gynecologists (ACOG) nor the guideline on multiple gestation of the Dutch Society for Obstetrics and Gynecology (NVOG) makes a recommendation for their route of delivery [6, 7]. Additionally, there is a general uncertainty about vaginal delivery of non-cephalic presenting twins, which is reflected by an increasing number of caesarean deliveries in twin gestations. In the United States, in 2003, 67% of all twins were delivered by a caesarean section. Some obstetricians cite ‘twins’ as their only indication [8]. A policy of planned caesarean section might increase the risk of neonatal and maternal complications, like neonatal respiratory problems [2] or maternal febrile morbidity [9].
This systematic review aims to determine if there are evidence-based recommendations for the optimal mode of delivery for non-cephalic presenting first and/or second twins. We will investigate the impact of the mode of delivery on neonatal outcome for twin deliveries with (1) twin A in non-cephalic presentation, (2) twin B in non-cephalic presentation and (3) both twins in non-cephalic presentation.

**Methods**

**Search strategy**

A computer-aided search of Medline, Embase, Cinahl and Cochrane databases was carried out. The following search terms (with synonyms) were used: ‘twins’, ‘non-cephalic’ and ‘delivery’ (Appendix 1). Reference lists of identified studies were searched for additional relevant studies.

**Inclusion criteria**

Studies that compared the neonatal outcome (5-min Apgar scores and neonatal mortality) after vaginal delivery with the neonatal outcome after caesarean delivery for non-cephalic presenting twins were included. Twin A, twin B or both twin(s) had to be in non-cephalic presentation. Data of neonatal outcome had to be presented according to the mode of delivery. The twin pregnancy had to reach at least 32 weeks of gestation and both of the twins had to weigh at least 1,500 g. Every study that was published in English language was considered for inclusion, except review articles, case reports or poster session abstracts.

**Selection of studies**

The first reviewer (CN) screened the titles and abstracts of identified studies for eligibility. Papers that seemed to be relevant were obtained, and the full text articles were read for inclusion. If there was doubt about the suitability of the studies, they were discussed with another independent reviewer (TE).

**Quality assessment**

The first reviewer (CN) independently assessed various aspects of methodological quality of the included studies without masking the source or authorship of the articles. The Cochrane Collaboration’s tool for assessing risk of bias was used [10]. This tool consists of nine items about selection-, performance-, detection-, attribution- and reporting bias. Furthermore, the included studies were scored according to the GRADE approach [10].

**Data extraction and analysis**

Due to the heterogeneity of the data, studies could not be pooled. Therefore, we described per study whether a significant difference between vaginal and caesarean delivery was found in (1) low 5-min Apgar scores (<7) and (2) neonatal mortality. The 5-min Apgar scores <7 are widely used in the literature as measurement for poor neonatal outcome [2, 3, 8]. We made a distinction between the neonatal outcome of twin A and twin B. Significant differences were defined according to the definitions and statistics used in the different studies. We described the studies according to the presentation of the twins, i.e. (1) twin A in non-cephalic presentation, (2) twin B in non-cephalic presentation and (3) both twins in non-cephalic presentation.

**Results**

We identified 578 articles. Nineteen articles reporting the results of 18 studies that compared vaginal delivery with caesarean delivery for non-cephalic presenting twins were included [9, 11–28] (Fig. 1).

**Quality assessment (Table 1)**

None of the 18 included studies were blinded since blinding for the mode of delivery was not possible for patients, personnel and outcome assessors.

According to the GRADE classification [10], only one randomized clinical trial was identified which was of high quality.
Table 1 Quality assessment: risk of bias

| Author               | Year | Study design | Selection bias | Performance bias | Attribution bias | Reporting bias | Total GRADE |
|----------------------|------|--------------|----------------|------------------|------------------|----------------|-------------|
|                      |      |              | Random sequence generation | Allocation concealment | Blinding of participants and personnel | Blinding of outcome assessment | 'high re-risk of bias' |           |
| Rabinovici [9]       | 1986 | RCT          | Low            | Low              | High             | Low            | Low         | 2           |
| Essel [11]^a         | 1996 | Prosp cohort | High           | High             | High             | High           | Unclear     | 4           |
| Sentilhes [12]       | 2007 | Retr cohort  | High           | High             | Low              | Low            | Unclear     | 4           |
| Grasaru [13]         | 2000 | Retr cohort  | High           | High             | Low              | Low            | Unclear     | 4           |
| Abu-Heija [14, 15]   | 1998 | Retr cohort  | High           | High             | Low              | Low            | Unclear     | 4           |
| Blickstein [16]^b     | 1993 | Retr cohort  | High           | High             | Low              | Low            | Unclear     | 4           |
| Wells [17]           | 1991 | Retr cohort  | High           | High             | Low              | Low            | Unclear     | 4           |
| Gocke [18]           | 1989 | Retr cohort  | High           | High             | Low              | Low            | Unclear     | 4           |
| Caukwell [19]        | 2002 | Retr cohort  | High           | High             | Low              | Low            | Unclear     | 5           |
| Winn [20]            | 2001 | Retr cohort  | High           | High             | Low              | Low            | Unclear     | 5           |
| Acker [21]           | 1981 | Retr cohort  | High           | High             | Low              | Low            | Unclear     | 5           |
| Atis [22]            | 2011 | Retr cohort  | High           | High             | Low              | High           | Unclear     | 6           |
| Nassar [23]          | 2004 | Retr cohort  | High           | High             | No               | High           | Unclear     | 6           |
| Roopmarinesingh [24] | 2002 | Retr cohort  | High           | High             | Low              | High           | Unclear     | 6           |
| Blickstein [25]      | 2000 | Retr cohort  | High           | High             | Low              | High           | Unclear     | 6           |
| Mauldin [26]         | 1998 | Prosp cohort | High           | High             | Low              | High           | Unclear     | 6           |
| Kelsick [27]         | 1982 | Retr cohort  | High           | High             | Low              | High           | Unclear     | 7           |
quality [9]. According to the Cochrane Collaboration’s Tool for assessing the risk of bias [10], this trial described adequate methods of randomisation and concealment of allocation. Two out of 33 women randomized for vaginal delivery subsequently underwent caesarean section (one because of inadequate progress of labour and another because of heart rate monitoring of twin B suggesting foetal distress). Neonatal outcome was completely described for both twins in this study.

The remaining moderate- [11] or low-quality [12–28] observational studies reported different completeness of neonatal outcome data for both twins. None of the observational studies provided information about how the possibility of selective outcome reporting was examined.

Twin A in non-cephalic presentation (Tables 2, 3)

Eight low-quality observational studies including 1,475 twin pairs compared the mode of delivery of twins with the twin A in non-cephalic presentation [12–16, 23–25, 27]. For twin A, none of the eight studies reported a significant difference in low 5-min Apgar scores or in neonatal mortality. For the twin B, no significant differences were reported, but in 50 % of the studies information about the neonatal outcome of twin B was lacking.

Twin B in non-cephalic presentation (Tables 2, 4)

Eleven studies including 2,166 twin pairs compared the mode of delivery of twins with twin B in non-cephalic presentation, including one high-quality randomized clinical trial [9] (60 twin pairs) and ten low-quality observational studies [17–22, 24, 26–28].

The randomized clinical trial that compared vaginal with caesarean delivery did not report a significant difference in low 5-min Apgar scores or in neonatal mortality for the twin A and B [9].

For the twin A, none of the studies did report significant differences in neonatal outcome but information about the neonatal outcome of twin A was lacking in 64 % (low 5-min Apgar scores) and 55 % (neonatal mortality) of the studies.

For the twin B, most studies (82 %) did not report a significant difference in low 5-min Apgar scores or neonatal mortality but one study [22] (482 twin pairs) did report a significant difference in low 5-min Apgar scores favouring caesarean delivery ($p < 0.05$). This study [22] did not report a significant difference in neonatal mortality.

Both twins in non-cephalic presentation (Tables 2, 5)

One moderate-quality observational study [11] including 68 twin pairs compared the mode of delivery of twins with
Table 2 Overview results

| Presentation of the twins | 5-min Apgar scores <7 | Neonatal mortality |
|---------------------------|-----------------------|--------------------|
|                           | No significant difference | Significant difference favouring vaginal delivery | Significant difference favouring caesarean delivery | Not reported | No significant difference | Significant difference favouring vaginal delivery | Significant difference favouring caesarean delivery | Not reported |
| Non-cephalic presentation twin A (8 studies [12–16, 23–25, 27]) | Twin A | 100 % (8 studies [12–16, 23–25, 27]) | – | – | – | 100 % (8 studies [12–16, 23–25, 27]) | – | – | – |
|                           | Twin B | 50 % (4 studies [12–16]) | – | – | – | 50 % (4 studies [23–25, 27]) | – | – | 50 % (4 studies [12–16]) |
| Non-cephalic presentation twin B (11 studies [9, 17–22, 24, 26–28]) | Twin A | 36 % (4 studies [9, 17, 18, 26]) | – | – | – | 64 % (7 studies [19–22, 24, 27, 28]) | – | – | 55 % (6 studies [19, 22, 24, 26–28]) |
|                           | Twin B | 82 % (9 studies [9, 17–21, 24, 26, 28]) | – | – | – | 9 % (1 study [27]) | 92 % (9 studies [9, 17–22, 24, 27]) | – | 18 % (2 studies [26, 28]) |
| Non-cephalic presentation twin A and B (1 study [11]) | Twin A | 100 % (1 study [11]) | – | – | – | 100 % (1 study [11]) | – | – | – |
|                           | Twin B | 100 % (1 study [11]) | – | – | – | 100 % (1 study [11]) | – | – | – |

Significant differences were defined according to the definitions and statistics used in the different studies

a Essel [11]: only the abstract was available
b Blickstein [16]: only the abstract was available
| Author          | Year   | Study design | Mode of delivery | Gestational age (weeks) | Presentation | Birth weight | 5-min Apgar score <7 | Neonatal mortality |
|-----------------|--------|--------------|-----------------|-------------------------|--------------|--------------|---------------------|--------------------|
|                 |        |              | VD/CS N (%)     | Twin A breech (%)      | Twin B cephalic (%) | Twin A (g)   | Twin B (g)          | Twin A N (%)       | Twin B N (%)       |
| Sentilhes [12]  | 2007   | Retr cohort  | VD 124 37 ± 1   | 100 %                   | 45 %         | 2,620 ± 363 | 2,555 ± 410         | 2 (2 %)            | 0 (1 %)            |
|                 |        |              | CS 71 37 ± 1    | 100 %                   | 52 %         | 2,762 ± 429 | 2,490 ± 446         | 2 (3 %)            | 1 (1 %)            |
|                  |        |              |                 |                         |              |             |                     |                    |
| Griasaru [13]   | 2000   | Retr cohort  | VD 33 >32       | 100 %                   | 52 %         | 2,636 ± 385 | 2,588 ± 456         | 0                  | 0                  |
|                 |        |              | CS 38 >32       | 89 %                    | NR           | 2,589 ± 450 | 2,488 ± 475         | 0                  | 0                  |
| Abu-Heija [14, 15]* | 1998   | Retr cohort  | VD 42 37 ± 3    | 100 %                   | NR           | 2,566 ± 555 | 2,450 ± 482         | NR                 | 3 (7 %)            |
|                 |        |              | CS 87 38 ± 2    | 100 %                   | NR           | 2,712 ± 553 | 2,577 ± 594         | NR                 | 2 (3 %)            |
| Blickstein [16]b | 1993   | Retr cohort  | VD 24 NR*       | 100 %                   | 100 %        | NR*         | NR*                | NR                 | NR                 |
|                 |        |              | CS 35 NR*       | 100 %                   | 100 %        | NR*         | NR*                | NR                 | NR                 |
| Nassar [23]     | 2004   | Retr cohort  | VD 35 36 ± 3    | 100 %                   | 35 %         | 2,274 ± 486 | NR                 | 3 %                | 6 %                |
|                 |        |              | CS 95 36 ± 3    | 100 %                   | 45 %         | 2,344 ± 617 | NR                 | 15 %               | 6 %                |
| Roopnarinesingh [24] | 2002   | Retr cohort  | VD 18 >32      | 100 %                   | NR           | 1,560–2,960 | NR                 | 0                  | NR                 |
|                 |        |              | CS 32 >32      | 100 %                   | NR           | 1,220–3,040 | NR                 | 0                  | NR                 |
| Blickstein [25] | 2000   | Retr cohort  | VD 53 36 ± 3    | 100 %                   | NR           | 2,454 ± 466 | 2,539 ± 547         | 7 (7 %)            | 0 (3 %)            |
| (Nullipara)     |        |              | CS 156 36 ± 2   | 100 %                   | NR           | 2,527 ± 485 | 2,441 ± 533         | 16 (5 %)           | NR                 |
| Retr cohort     |        |              | VD 129 37 ± 2   | 100 %                   | 49 %         | 2,609 ± 524 | 2,626 ± 519         | 14 (5 %)           | 1 (0.4 %)          |
| (Multipara)     |        |              | CS 167 37 ± 3   | 100 %                   | 44 %         | 2,662 ± 551 | 2,577 ± 568         | 17 (5 %)           | 0 (0.3 %)          |
| Kelsick [27]    | 1982   | Retr cohort  | VD 194 NR       | 100 %                   | NR           | 2,000–4,000 | NR                 | 2 (1 %)            | NR                 |
|                 |        |              | CS 142 NR       | 100 %                   | NR           | 2,000–4,000 | NR                 | 2 (1 %)            | NR                 |

Significant differences were defined according to the definitions and statistics used in the different studies.

VD Vaginal delivery, CS Caesarean section, N Number of twin pairs, Retr Retrospective, NR Not reported.

*a* Abu-Heija [14, 15] did not report the percentage of 5-min Apgar scores <7, but did report the mean 5-min Apgar scores: 8 ± 1 in all groups (without significant differences).

*b* Blickstein [16]: only the abstract was available.
Discussion

The aim of the current review was to compare vaginal with caesarean delivery for twin deliveries with twin A in non-cephalic presentation, twin B in non-cephalic presentation and both twins in non-cephalic presentation. This evaluation is important because of the increasing numbers of caesarean sections without adequate supporting evidence for their use [8].

One high-quality clinical trial [9] (60 twin pairs) and 16 moderate/low-quality observational studies [11–21, 23–28] (3,167 twin pairs) showed no difference in neonatal outcome between vaginal and caesarean deliveries in twin A and/or B. Only one low-quality observational study [22] (482 twin pairs) reported a significant difference in low 5-min Apgar scores favouring caesarean delivery but there was no significant difference in neonatal mortality.

A reason to recommend caesarean over vaginal delivery if twin A is presenting non-cephally might be to avoid the possibility of interlocking twins, which theoretically could occur in breech/cephalic and breech/transverse presenting twins. However, the incidence of interlocked twins is very low [1]. Furthermore, according to Hannah et al. [29] in term breech singletons, planned caesarean section is better than vaginal delivery. However, a previous Cochrane review did describe the maternal and neonatal outcome of the same clinical trial [9] we cited, and they stated that caesarean delivery of a non-cephalic presenting twin B is associated with increased maternal morbidity but not with improved neonatal outcome, and that a policy of caesarean delivery should not be adopted without further controlled trials [30]. Additionally, previous research did not find excessive morbidity or mortality associated with vaginal delivery of non-cephalic presenting twins compared with cephalic presenting twins [31–35]. Because we include only studies that compared non-cephalic presenting twins with each other, these reports were excluded.

A few studies provided detailed information about the mode of vaginal delivery like external cephalic version or (assisted) breech extraction. Both external version [36–38] and breech extraction [39–41] are recommended in the literature. To our knowledge, there are no randomized controlled data comparing external version with breech extraction. Future research about this subject might be useful.

A limitation of this review is that the included studies had relatively small sample sizes. However, in a meta-analysis from 2003, Hodge et al. [2] pooled the data of four studies that we described separately [9, 13, 17, 25]. They remarked that even the sample size of the pooled data was too small to draw conclusions. Therefore, although after including more recent studies statistic evidence for the best mode of delivery for twins presenting non-cephally is still missing and no strong recommendation can be made. Furthermore, most studies did not correct (statistically or by randomisation) for confounding factors. Important confounding factors are parity or medical, obstetric or emergency indications for a caesarean section.

Additionally, most studies did not provide information about monoamnioticity. Therefore, it is mostly unknown if only diamniotic twins were included, or if monoamniotic and diamniotic twins were mixed. Ideally, you should analyse these groups separately. However, the bias due to this cause might be limited if the percentage of monoamniotic twins is equal in both the vaginal and the caesarean delivery group.

Finally, in two studies [11, 16], we used information from the abstract only because we were not able to get full text of both papers. However, we were able to retrieve all information we needed from the abstract, but ideally studies should be assessed with the full text available.

Therefore, our results have to be interpreted with caution.

Conclusion

Our results do not suggest benefit of caesarean over vaginal delivery for selected twin gestations with twin A and/or twin B in non-cephalic presentation. However, no final conclusion can be drawn. Randomized studies with sufficient power are required to make a strong recommendation.

Conflict of interest None of the authors have conflict of interest.

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Appendix 1

Medline: ((((((twins>Title/Abstract) OR twin>Title/Abstract)) OR sibling>Title/Abstract)) OR siblings>Title/Abstract)) OR reciprocal>Title/Abstract)) OR reciprocals>Title/Abstract)) AND ((((((breech presentation>Title/Abstract) OR breech-presentation>Title/Abstract)) OR breech-presentations>Title/Abstract)) OR breech>Title/Abstract)) OR non-vertex>Title/Abstract)) OR non-vertex-presentation>Title/Abstract)) OR non-vertex-presentations>Title/Abstract)) OR non-cephalic>Title/Abstract)) OR
| Author          | Year | Study design | Mode of delivery | Gestational age (weeks) | Presentation | Birth weight | 5-min Apgar score <7 | Neonatal mortality |
|-----------------|------|--------------|------------------|-------------------------|--------------|--------------|-----------------------|--------------------|
|                 |      |              |                  |                         | Twin A cephalic (%) | Twin B breech (%) | Twin A (g) | Twin B (g) | Twin A N (%) | Twin B N (%) | TWIN A N (%) | TWIN B N (%) |
| **Differences in neonatal outcome** |      |              |                  |                         | 100 % | NR          | NR | 2,335 ± 443 | NR | 44 (15 %) | NR | 2 (1 %) |
| Atis [22]a      | 2011 | Retr cohort  | VD               | 289                     | 36 ± 6 | 100 %       | NR          | 2,335 ± 443 | NR | 44 (15 %) | NR | 2 (1 %) |
|                 |      |              | CS               | 193                     | 36 ± 6 | 100 %       | NR          | 2,558 ± 648 | NR | 16 (8 %) | NR | 1 (1 %) |
| **No differences in neonatal outcome** |      |              | VD               | 33                      | 38 ± 2 | 100 %       | 61 %        | 2,477 ± 370 | 0 | 1 (3 %) | 0 | 0 |
| Rabinovici [9]  | 1986 | RCT          | CS               | 27                      | 38 ± 2 | 100 %       | 67 %        | 2,533 ± 423 | 1 (4 %) | 1 (4 %) | 0 | 0 |
| **Wells [17]**  | 1991 | Retr cohort  | VD-breech extraction | 42                     | 37 | 100 %       | 100 %       | 2,660 | 2,537 | 0 | 1 (2 %) | 0 | 0 |
|                 |      |              | CS               | 29                      | 37 | 100 %       | 100 %       | 2,701 | 2,521 | 0 | 0 |
| **Gocke [18]**  | 1989 | Retr cohort  | VD-breech extraction | 55                     | 37 | 100 %       | 100 %       | 2,544 | 2,569 | 0 | 1 (3 %) | 0 | 0 |
|                 |      |              | CS               | 40                      | 36 | 100 %       | 100 %       | 2,399 | 2,365 | 0 | 0 |
| **Caukwell [19]a** | 2002 | Retr cohort  | VD               | 64                      | ≥37 | NR          | NR          | NR | NR | 4 (6 %) | NR | 0 |
|                 |      |              | CS               | 34                      | ≥37 | NR          | NR          | NR | NR | 3 (9 %) | NR | 0 |
| **Winn [20]b**  | 2001 | Retr cohort  | VD               | 31                      | 34 ± 2 | NR          | 100 %       | NR | 2,115 ± 415 | NR | 0 |
|                 |      |              | CS-without labour | 34                     | 35 ± 2 | NR          | 100 %       | NR | 2,242 ± 456 | NR | 0 |
|                 |      |              | CS-with labour   | 36                      | 34 ± 2 | NR          | 100 %       | NR | 2,215 ± 442 | NR | 0 |
| **Acker [21]f** | 1981 | Retr cohort  | VD               | 76                      | NR | NR          | 100 %       | >1,500 | >1,500 | NR | 11 (15 %) | 0 | 0 |
|                 |      |              | CS               | 75                      | NR | NR          | 100 %       | >1,500 | >1,500 | NR | 7 (10 %) | 0 | 0 |
| Author                  | Year | Study design | Mode of delivery | Gestational age (weeks) | Presentation | Birth weight | 5-min Apgar score <7 | Neonatal mortality |
|-------------------------|------|--------------|------------------|------------------------|--------------|--------------|---------------------|-------------------|
| Roopnarinesingh         | 2002 | Retr cohort  | VD               | >32                    | NR           | NR           | 1,560–2,960         | NR                |
|                         |      |              | CS               | >32                    | NR           | NR           | 1,220–3,040         | NR                |
| Mauldin [26]a           | 1998 | Prosp cohort | VD-breech extraction | 35 ± 4               | NR           | NR           | 2,233 ± 561         | NR                |
|                         |      |              | VD-external version | 34 ± 2               | NR           | NR           | 2,295 ± 702         | NR                |
|                         |      |              | CS               | 35 ± 4                | NR           | NR           | 2,169 ± 680         | NR                |
| Kelsick [27]            | 1982 | Retr cohort  | VD               | NR                    | NR           | NR           | 2,000–4,000         | NR                |
|                         |      |              | CS               | NR                    | NR           | NR           | 2,000–4,000         | NR                |
| Greig [28]e,d           | 1992 | Retr cohort  | VD (1,500–1,999 g) | 12                   | NR           | NR           | 1,500–1,999         | NR                |
|                         |      |              | CS (1,500–1,999 g) | 24                   | NR           | NR           | 1,500–1,999         | NR                |
|                         |      |              | Retr cohort VD (2,000–2,499 g) | 21                   | NR           | NR           | 1,500–1,999         | NR                |
|                         |      |              | Retr cohort CS (2,000–2,499 g) | 31                   | NR           | NR           | 1,500–1,999         | NR                |
|                         |      |              | Retr cohort VD (≥2,500 g) | 21                   | NR           | NR           | 1,500–1,999         | NR                |
|                         |      |              | Retr cohort CS (≥2,500 g) | 46                   | NR           | NR           | 1,500–1,999         | NR                |

Significant differences were defined according to the definitions and statistics used in the different studies.

VD Vaginal delivery, CS Caesarean section, N Number of twin pairs, RCT Randomized controlled trial, Retr Retrospective, Prosp Prospective, NR Not reported

a Atis [22], Caukwell [19], Mauldin [26], Greig [28]: twin B in non-cephalic position, not further specified to breech or transverse position

b Winn [20] did not report the percentage of 5-min Apgar scores <7, but did report the mean 5-min Apgar scores: 8 ± 1 in VD and CS-with labour group, and 9 ± 1 in the CS-without labour group (without significant differences)

c Acker [21]: twins delivered by caesarean section: twin A or B was in non-cephalic presentation

d Greig [28] did not report the percentage of 5-min Apgar scores <7, but did report the mean 5-min Apgar scores: 1,500–1,999 g and 2,000–2,499 g: 9 in the VD and 8 in the CS group (without significant differences); 2,500 g: 9 in the VD group and 9 in the CS group (without significant differences)
**Table 5** Both twins in non-cephalic presentation

| Author       | Year | Study design | Mode of delivery | Gestational age (weeks) | Presentation | Birth weight | 5-min Apgar score <7 | Neonatal mortality |
|--------------|------|--------------|------------------|-------------------------|--------------|--------------|---------------------|-------------------|
| Essel [11]   | 1996 | Prosp cohort | VD 41 NR         | Twin A breech (%)       | NRa          | Twin A N (%) | p > 0.05            | Twin A N (%)      |
|              |      |              | SC 27 NR         | Twin B breech (%)       | NRa          | Twin B N (%) | p > 0.05            | Twin B N (%)      |

Significant differences were defined according to the definitions and statistics used in the different studies.

VD: Vaginal delivery, CS: Caesarean section, N: Number 1 of twin pairs, Prosp: Prospective, NR: Not reported.

*a* Essel [11]: only the abstract was available.

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non-cephalic-presentation[Title/Abstract]) OR non-cephalic-presentations[Title/Abstract]) AND ((((((((vaginal delivery[Title/Abstract] OR vaginal[Title/Abstract] OR vaginally[Title/Abstract] OR deliver[Title/Abstract] OR delivered[Title/Abstract] OR delivery[Title/Abstract] OR deliveries[Title/Abstract] OR childbirth[Title/Abstract] OR childbirths[Title/Abstract] OR accouchement[Title/Abstract] OR bearing[Title/Abstract] OR birth[Title/Abstract] OR births[Title/Abstract] OR birthing[Title/Abstract] OR bringing forth[Title/Abstract] OR childbearing[Title/Abstract] OR confinement[Title/Abstract] OR geniture[Title/Abstract] OR labor[Title/Abstract] OR labour[Title/Abstract] OR lying-in[Title/Abstract] OR paturition[Title/Abstract] OR parturitions[Title/Abstract] OR travail[Title/Abstract] OR extraction[Title/Abstract] OR extractions[Title/Abstract] OR caesarian section[Title/Abstract] OR caesarian sections[Title/Abstract] OR caesarian[Title/Abstract] OR caesarians[Title/Abstract] OR section[Title/Abstract] OR sections[Title/Abstract] OR abdominal[Title/Abstract] OR abdominally[Title/Abstract]) Field: abstract.

Cochrane: (Twin OR twins OR sibling OR siblings OR reciprocal OR reciprocals) AND (breech-presentation OR breech-presentation OR breech OR non-vertex OR non-cephalic) AND (vaginal OR vaginally or deliver OR delivered OR delivery OR deliveries OR childbirth OR childbirths OR accouchement OR bearing OR birth OR births OR birthing OR brining forth OR childbearing OR confinement OR geniture OR labor OR labour OR caesarian OR caesarians OR section OR sections OR abdominal OR abdominally) Field: abstract.

CINAHL: (Twin OR twins OR sibling OR siblings OR reciprocal OR reciprocals) AND (breech-presentation OR breech-presentation OR breech OR non-vertex OR non-cephalic) AND (vaginal OR vaginally or deliver OR delivered OR delivery OR deliveries OR childbirth OR childbirths OR accouchement OR bearing OR birth OR births OR birthing OR brining forth OR childbearing OR confinement OR geniture OR labor OR labour OR caesarian OR caesarians OR section OR sections OR abdominal OR abdominally) Field: abstract.

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