Pregnancy outcomes in breech presentation at term: a comparison between 2 third level birth center protocols

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BACKGROUND: Medical literature supports planned cesarean delivery for breech presentation at term because of observed reductions in neonatal morbidity and mortality compared with vaginal breech delivery.

OBJECTIVE: This study aimed to compare perinatal outcomes of singleton pregnancies with breech presentation at term according to the different delivery protocols of 2 teaching hospitals, where vaginal breech delivery (protocol 1) or cesarean delivery (protocol 2) is routinely offered, respectively.

STUDY DESIGN: A retrospective matched cohort study was conducted between January 2015 and May 2021. A total of 1079 women were eligible for analysis. After matching for possible confounding factors, the final analysis was performed on 257 patients in each group. The primary outcomes were a composite of adverse obstetrical outcomes and a composite of neonatal adverse outcomes.

RESULTS: Overall, 1079 women were eligible for analysis. After matching for possible confounding factors, the final analysis was performed on 257 patients in each group. The composite of adverse obstetrical outcomes was similar in the 2 groups (24.1% vs 24.5%; P=1.000); however, the composite of neonatal adverse outcomes was significantly higher for protocol 1 (17.9% vs 1.2%; P<.001). No neonatal death or birth trauma was reported in either group. The rates of neonatal intensive care unit admission (4.3% vs 0.4%; P=.004), respiratory distress at birth (17.5% vs 1.2%; P<.001), and Apgar scores of <7 after 5 minutes (5.8% vs 0.4%; P<.001) were significantly higher for protocol 1.

CONCLUSION: Short-term, nonsevere adverse neonatal outcomes were significantly increased in the protocol 1 group. These must be balanced against the possible negative effects of cesarean delivery on long-term infant and maternal health.

Key words: breech presentation, delivery route, neonatal outcome, obstetrical outcome

Introduction

The prevalence of breech presentation declines with advancing gestation, accounting for only 3% to 4% of cases at term. The outcomes for breech deliveries are worse than their cephalic counterparts, regardless of birth mode. In these cases, the literature suggests that planned cesarean delivery (CD) is associated with less perinatal complications, including intraventricular hemorrhage, seizures, low Apgar scores, brachial plexus injury, and intrapartum and neonatal death, than vaginal breech delivery (VBD).1–3

Since the publication of the Term Breech Trial (TBT) in 2000, the rate of VBD has rapidly declined. However, the methodology, organization, and peer review process of the TBT have been heavily criticized in the following years.4–8 One of the main criticisms concerns the inappropriateness of data extrapolation. An analysis of trends in perinatal mortality after the TBT demonstrates that increasing CD rates may account for only 16% of the observed decline in birth-related perinatal deaths,9 suggesting that the mode of delivery is a relatively minor contributing factor and that the whole management protocol has probably more influence on pregnancy outcomes. The long-term follow-up of TBT, published in 2004, revealed 2 other important findings.10 First, the prevalence of death or abnormal neurodevelopment at 2 years of age did not differ according to the intended mode of birth; second, an excess of medical complications was found in babies delivered by CD. All of these findings reinforced the theory that vaginal birth itself, regardless of presentation, protects against childhood infections and some other non-transmissible diseases. As a consequence, it was proposed to withdraw the original TBT recommendations4 and to question their validity.4,11

Given the inconsistencies in medical literature, some authors continue to suggest that VBD in selected populations...
can be as safe as an elective CD. In centers where planned VBD is commonly practiced, the use of strict eligibility criteria and clear management protocols seems to be associated with a low risk of neonatal complications.\(^5\)\(^,\)\(^6\)\(^,\)\(^12\)\(^,\)\(^13\) However, based on the large body of research available in the literature, many argue that the risk of neonatal complications during VBD is unacceptably high.\(^14\)\(^–\)\(^17\) A recently published meta-analysis of randomized and observational studies is frequently cited as conclusive evidence of the dangers associated with planned VBD at term, leading some—although not the authors themselves—to suggest that the debate should now be closed.\(^18\)

Nonetheless, the ongoing discourse within the obstetrical community, coupled with several reassuring publications since the TBT, has led to a reconsideration of vaginal breech birth by various authorities.

In the background of this contradictory short- and long-term data, we sought to compare neonatal and maternal outcomes of singleton pregnancies with breech presentation at term according to the different delivery protocols of 2 teaching hospitals, where VBD (protocol 1) or CD (protocol 2) is routinely offered. Our objective was to compare the 2 different management care pathways for breech presentations at term rather than just the modes of birth.

### Material and Methods

#### Study design

This was an international retrospective cohort study conducted in 2 university hospitals in Europe. Our study population included all pregnant women with a viable singleton fetus in frank or complete breech presentation, delivery at >34 weeks of gestation (WG), and a known pregnancy outcome between January 1, 2015, and May 31, 2021. We compared neonatal and maternal outcomes resulting from 2 different care pathways (Appendix): the first group of patients (protocol 1) was delivered at Brugmann University Hospital, Brussels, Belgium, a center that routinely offers vaginal breech birth, and the second group of patients (protocol 2) was delivered at Fondazione Policlinico Universitario Agostino Gemelli, IRCCS, Rome, Italy, where—in case of breech presentation—patients are routinely assigned to elective CD.

We excluded all pregnancies with contraindication to VBD, fetuses in breech presentations other than frank or complete breech, congenital anomalies, estimated fetal weights of <2500 g or >3800 g, and pregnancies with an unknown outcome. In patients who had ≥2 pregnancies with a breech presentation during the study period, only the first pregnancy was included.

The study was approved by the ethical board of each center (identification numbers: CE 2021/123 and IST DIPUSVSP-25-06-2142), and informed consent was waived.

#### Data collection

Clinical data were routinely collected in real time into the patient’s electronic medical records. Furthermore, data were extracted retrospectively for the study and merged into a dedicated, secured, and anonymized database. A data control was performed before any analysis, and in cases where there were inaccurate or missing data, the recruiting centers were contacted for clarification.

The collated data included maternal age, geographic origin, prepregnancy body mass index (BMI), weight gain in pregnancy, parity, number of previous VBD or CD, smoking status, chronic arterial hypertension, diabetes mellitus type I or II, preexisting pulmonary diseases (such as asthma, tuberculosis, and previous pulmonary embolism), and preexisting renal or liver diseases (such as renal or hepatic insufficiency, polycystic kidney disease, single kidney, previous nephrectomy, viral hepatitis, and kidney or liver transplant), gestational diabetes mellitus, gestational hypertension, preeclampsia, and fetuses small or large for gestational age (GA).

### Study outcomes

The primary outcomes of the study were a composite adverse obstetrical outcome (CAOO) and a composite neonatal adverse outcome (CANO). The secondary outcomes of the study included each variable of these composite outcomes.

#### Definition of variables and outcomes

All considered variables are listed in Table 1. The criteria for neonatal intensive care unit (NICU) admission are comparable in both centers. They include GA at birth of ≤32 WG, birthweight of ≤1500 g, signs of respiratory distress, hemodynamic instability, metabolic problems needing central venous access placement and intensive care, perinatal asphyxia defined according to the American College of Obstetricians and Gynecologists (ACOG) and American Academy of Pediatrics criteria, and need for exchange transfusion.\(^19\)

#### Statistical analysis

Data were analyzed with the SPSS 26 statistical software (IBM SPSS Statistics). Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were expressed as...
Furthermore, we used the test to examine the equality of variances of continuous variables, and the Levene Wilk test to test the normal distribution and GA at delivery. We used the Shapiro-Wilk test to examine the equality of variances. Furthermore, we used the t test to compare the means of both groups, respectively. For comparison of the categorical variables, we used either the Fisher exact test or the Pearson chi-squared test as indicated. Statistical significance was assumed when the P value was \( \leq 0.05 \).

**Results**

Overall, we identified 1232 singleton pregnancies with the fetus in frank or complete breech presentation and delivery at \( \geq 34 \) WG; moreover, 1079 patients (87.6%) met the inclusion criteria (Figure 1) and were eligible for analysis. Among those patients, 385 (35.7%) were observed in the first center (protocol 1), and 694 (63.3%) were observed in the second center (protocol 2). In protocol 1, 66 of 385 patients (17%) agreed to an attempt at VBD, 48 of which delivered vaginally (success rate of 72%). In protocol 2, all 694 patients, but 3, delivered by CD.

After matching for possible confounding factors, the final analysis was performed on 257 patients in each group, all of whom were at \( \geq 370 \) WG. Table 2 displays baseline characteristics for individuals in both groups before and after matching, demonstrating that none of the demographic and clinical characteristics were significantly different between the 2 groups. The mean maternal age was 31.0±5.4 years old, mean GAs at delivery were 38.5±0.9 weeks in group 1 and 38.7±0.9 weeks in group 2, 53.7% were primipara, and 10.5% of patients had a previous 1 CD (Table 2).

We found that the CAOO was similar in the 2 groups (24.1% vs 24.5%; \( P=1.000 \)), but the CANO was significantly higher in patients of protocol 1 (17.9% vs 1.2%; \( P<.001 \)) (Tables 3 and 4).

The rate of postpartum blood loss of \( >1000 \) mL was significantly higher in protocol 1 (8.9% vs 1.9%; \( P<.001 \)). Nevertheless, the rate of the remaining secondary outcomes was comparable between both groups (Table 3), with no reported transfusion or admission to intensive care.

There was no neonatal death or birth trauma reported in either group. The rates of NICU admission (4.3% vs 0.4%; \( P=.004 \)), respiratory distress at birth (17.5% vs 1.2%; \( P<.001 \), and Apgar score of \(<7\) after 5 minutes (5.8% vs 0.4%; \( P<.001 \)) were significantly higher in protocol 1 than in protocol 2 (Table 4). Of note, 12 neonates were admitted to the NICU with a median duration of hospitalization of 2.5 days (range, 1–23 days), and all neonates were discharged in good conditions. Of these 12 neonates, 4 (33.3%) were admitted to the NICU with a median duration of hospitalization of 2.5 days.

**TABLE 1**

**Definition of variables and outcomes**

| Composite adverse obstetrical outcome | Unscheduled CD |
|--------------------------------------|----------------|
|                                      | Postpartum hemorrhage >1000 mL |
|                                      | Need for blood transfusion    |
|                                      | Manual revision or dilatation and curettage for bleeding or retained placental tissue |
|                                      | Hysterectomy                  |
|                                      | Cervical laceration involving the lower uterine segment (vaginal breech delivery) |
|                                      | Use of forceps                |
|                                      | Vertical uterine incision or serious extension to a transverse uterine incision (cesarean delivery) |
|                                      | Vulvar or perineal hematoma requiring evacuation |
|                                      | Admission to the ICU           |
|                                      | Deep venous thrombosis or pulmonary embolism |
|                                      | Wound infection requiring prolonged hospital stay or readmission to hospital |
|                                      | Maternal fever of at least 38.5°C on 2 occasions at least 24 h apart (not including the first 24 h) |
|                                      | Bladder, ureter, or bowel injury |
|                                      | Bowel obstruction              |
|                                      | Maternal death                |
|                                      | Composite adverse neonatal outcome |
|                                      | Birth trauma (subdural hematoma, intracerebral or intraventricular hemorrhage, spinal cord injury, basal skull fracture, peripheral nerve injury present at discharge from hospital, or clinically significant genital injury) |
|                                      | Seizures occurring at <24 h of age or requiring ≥2 drugs |
|                                      | Admission to the NICU          |
|                                      | Neonatal respiratory distress  |
|                                      | Intraventricular hemorrhage    |
|                                      | Apgar score of <7 at 5 min     |
|                                      | Cord blood pH<7                |
|                                      | Hypotonia for a least 2 h      |
|                                      | Stupor, decreased response to pain, or coma |
|                                      | Intubation and ventilation for at least 24 h |
|                                      | Tube feeding for ≥4 d          |
|                                      | Neonatal death                |

\( CD \): Cesarean delivery; \( ICU \): Intensive care unit; \( NICU \): Neonatal intensive care unit.

Bevilacqua. Delivery route in breech presentation. Am J Obstet Gynecol Glob Rep 2022.
FIGURE 1
Flowchart of the study population

![Flowchart showing study population flow](chart.png)

Exclusion criteria
- More than 1 previous CD: 10
- LGA or SGA: 98
- Contraindication for VBD: 30
- Congenital anomalies: 9
- Second pregnancy with breech presentation during the study period: 4
- IUFD: 2

CD, cesarean delivery; GA, gestational age; IUFD, intrauterine fetal demise; LGA, large for gestational age; SGA, small for gestational age; VBD, vaginal breech delivery; WG, weeks of gestation.

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TABLE 2
Baseline characteristics of the study population before and after matching

| Variable                       | Before matching | After matching |
|-------------------------------|-----------------|---------------|
|                               | Protocol 1 (n=385) | Protocol 2 (n=694) | Protocol 1 (n=257) | Protocol 2 (n=257) |
| **Age (y)**                   | 30.0±5.5        | 34.4±5.5      | 31.3±5.4        | 31.5±5.4        | .656 |
| **Race**                      |                 |               |                 |                 | 1.000 |
| White                         | 342 (88.8)      | 653 (94.1)    | 241 (93.8)      | 241 (93.8)      |     |
| Black                         | 26 (6.8)        | 21 (3.0)      | 10 (3.9)        | 10 (3.9)        |     |
| Others                        | 17 (4.4)        | 20 (2.9)      | 6 (2.3)         | 6 (2.3)         |     |
| **Prepregnancy BMI (kg/m²)**  | 24.6±4.8        | 23.9±4.7      | 24.7±4.8        | 24.3±5.1        | .245 |
| **Weight gain during pregnancy (kg)** | 12.0±6.1        | 11.2±4.4      | 12.4±6.3        | 12.1±4.6        | .793 |
| **Primipara**                 | 156 (40.5)      | 488 (70.3)    | 138 (53.7)      | 138 (53.7)      | 1.000 |
| **Previous single cesarean delivery** | 36 (9.4)        | 88 (12.7)     | 27 (10.5)       | 27 (10.5)       |     |
| **Smoking**                   | 35 (9.1)        | 33 (4.8)      | 25 (9.7)        | 14 (5.6)        | .095 |
| **Chronic hypertension**      | 3 (0.8)         | 5 (0.7)       | 2 (0.8)         | 0 (0)           | .156 |
| **DM I or II**                | 4 (1.0)         | 8 (1.2)       | 4 (1.6)         | 1 (0.4)         | .178 |
| **GDM**                       | 67 (17.4)       | 99 (14.3)     | 44 (17.1)       | 34 (13.2)       | .268 |
| **Preeclampsia spectrum**     | 4 (1.0)         | 8 (1.2)       | 2 (0.8)         | 3 (1.2)         | .653 |
| **Gestational age at delivery (wk)** | 38.6±1.0        | 38.6±0.9      | 38.5±0.9        | 38.7±0.9        | .078 |

BMI, body mass index; DM I or II, diabetes mellitus type I or II; GDM, gestational diabetes mellitus.

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### TABLE 3
Comparison of the obstetrical outcomes between both protocols

| Variable | Protocol 1 (n=257) | Protocol 2 (n=257) | P value |
|----------|--------------------|--------------------|---------|
| Composite adverse obstetrical outcome | 62 (24.1) | 63 (24.5) | 1.000 |
| Secondary outcomes | | | |
| Unscheduled CD | 43 (18.9) | 59 (23.0) | .270 |
| Postpartum blood loss > 1000 mL | 23 (8.9) | 5 (1.9) | .001 |
| Blood transfusion | 0 (0) | 1 (0.4) | — |
| ICU admission | 0 (0) | 0 (0) | — |
| DVT or PE | 0 (0) | 0 (0) | — |
| Wound infection requiring prolonged hospital stay or readmission | 1 (0.4) | 0 (0) | .317 |
| Fever | 1 (0.4) | 0 (0) | .317 |
| Visceral injury | 0 (0) | 0 (0) | — |
| Vertical uterine incision or serious extension of a transverse uterine incision | 0 (0) | 0 (0) | — |
| Forceps delivery | 0 (0) | 0 (0) | — |
| Cervical lacerations | 0 (0) | 0 (0) | — |
| Vulvar or perineal hematoma | 0 (0) | 0 (0) | — |
| Perineal tear (third or fourth degree) | 0 (0) | 0 (0) | — |
| Maternal death | 0 (0) | 0 (0) | — |

CD, cesarean delivery; DVT, deep vein thrombosis; ICU, intensive care unit; PE, pulmonary embolism.

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### TABLE 4
Comparison of the obstetrical outcomes between both protocols

| Variable | Protocol 1 (n=257) | Protocol 2 (n=257) | P value |
|----------|--------------------|--------------------|---------|
| Composite adverse neonatal outcome | 46 (17.9) | 3 (1.2) | <.001 |
| Secondary outcomes | | | |
| Neonatal death | 0 (0) | 0 (0) | — |
| Birth trauma | 0 (0) | 0 (0) | — |
| Seizures | 0 (0) | 1 (0.4) | .317 |
| NICU admission | 11 (4.3) | 1 (0.4) | .004 |
| Respiratory distress at birth | 45 (17.5) | 3 (1.2) | <.001 |
| Intraventricular hemorrhage | 2 (0.8) | 0 (0) | .156 |
| Apgar score of < 7 at 5 min | 15 (5.8) | 1 (0.4) | <.001 |
| Arterial pH < 7.00 | 1 (0.4) | 1 (0.4) | 1.000 |
| Hypotonia | 0 (0) | 0 (0) | — |
| Stupor or coma | 0 (0) | 0 (0) | — |
| Endotracheal intubation | 2 (0.8) | 1 (0.4) | .563 |
| Parenteral feeding | 0 (0) | 0 (0) | — |
| Birthweight (g) | 3220.5 ± 425.5 | 3198.2 ± 380.2 | .531 |

NICU, neonatal intensive care unit.

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delivered by VBD, 4 (33.3%) were delivered by unscheduled CD, and 4 (33.3%) were delivered by scheduled CD. Moreover, 48 neonates had respiratory distress at birth, 45 in protocol 1 and 3 in protocol 2. Among these neonates, endotracheal intubation was necessary for 2 neonates in protocol 1 and 1 neonate in protocol 2.

Discussion
Main findings
This study directly compared 2 different management protocols for breech presentations at term rather than just comparing pregnancy outcomes by mode of birth. The analysis did not show significant differences between the 2 protocols in terms of obstetrical outcomes. In contrast, short-term, nonsevere neonatal outcomes seemed to be worse in the center offering VBD.

Comparison with literature
The most remarkable result to emerge from the data, following the result of the TBT, is that adverse perinatal outcomes were significantly higher in the center offering a VBD for breech presentation. However, only 3 components of the CANO were significantly worse (Apgar score of <5 at 7 minutes; respiratory distress at birth, not respiratory distress syndrome; and NICU admission), although no difference in severe outcomes (trauma, pH<7.0, intracerebral hemorrhage, convulsions, and death) was found. Abnormal Apgar scores in the absence of significant acidosis (pH<7.0) do not predict long-term neurodevelopmental complications, neither do short-term respiratory distress or NICU admission.

Although there was no difference in composite maternal outcomes (CAOO), an increase in cases of postpartum hemorrhage (PPH) of >1000 mL was noted in protocol 1 (8.9% vs 1.9%); however, most cases were unrelated to trauma, but no patient required transfusion or admission to intensive care. This finding was difficult to explain given that the rate of unscheduled cesarean delivery was similar for both protocols; however, a large study comparing complications by mode of birth also found a nonsignificant increase in PPH of >1000 mL in the vaginal group.6,20 Furthermore, the Belgian group is currently analyzing its data over the last few years because of a higher-than-average incidence of significant PPHs during vertex vaginal birth.

Most large individual studies focusing on term breech deliveries, except for the TBT, are either retrospective or based on registry data. Nonetheless, many studies have demonstrated that VBD at term is associated with an increased neonatal risk compared with CD,21–23 but at the cost of increased maternal complications.7 In contrast, several observational or retrospective studies from centers with clear management protocols have shown no excess of serious perinatal risk in planned VBD compared with planned CD. The highest available level of evidence is the meta-analysis of Berhan,2 which confirmed the findings of the TBT. Despite these results, the authors continued to support individualized decision-making for breech presentation at term rather than a blanket policy of birth by CD, perhaps because they found a significant increase in maternal morbidity (relative risk, 1.29; 95% confidence interval, 1.03–1.6).

Speaking of VBD, we should mention the role of pelvimetry in the decision-making process of the management of a breech presentation at term. Normal magnetic resonance imaging (MRI) pelvimetry was a prerequisite to authorize a VBD in protocol 1. However, the role of pelvimetry is unclear.24 Some authors reported that the use of pelvimetry reduced the emergency cesarean delivery rate, but further evidence is required to more clearly delineate the role of pelvimetry in breech presentation fetuses at term.6,24,25 Moreover, we should not forget the problem related to cost and limited availability of most facilities for using MRI.

At this point, how do we reconcile reassuring results of experienced centers using strict inclusion criteria and precise management protocols with those of larger multicenter interventional studies and a meta-analysis that questions the security of VBD at term? Of note, 1 compelling argument was brought by Kotaska,26 who questioned the role of randomized controlled trials (RCTs), specifically citing the TBT, to help resolve complex clinical conundrums. The author pleaded that “we must recognize and respect their limitations (RCTs) when examining complex phenomena in heterogeneous populations.” The TBT examined a specific management protocol, which differed from many others where outcomes were significantly better for those delivering by VBD. This highlighted the importance of a whole package of care for term breech rather than just the mode of birth, as many other factors have the potential to influence pregnancy outcomes, in particular the inclusion criteria and the experience of the team involved during the labor and delivery. Furthermore, the comparator for vaginal breech at term is always planned cesarean delivery, which is unfair as this abruptly terminates the pregnancy at 39 WG, thus immediately reducing the risk of perinatal mortality. A better comparison would be the perinatal outcomes of cephalic vaginal birth at term, but unfortunately, there is a paucity of quality data in this area.

Strengths and limitations
Both centers in our study follow the same guidelines for prenatal, postnatal, and neonatal care, but we use different packages of care for breech presentation at term. Overall, 1079 patients were eligible for analysis, but only 514 patients were kept after matching for possible confounding variables. This design balances both groups of the study to decrease the effect of confounding variables. The retrospective methodology increases the risk of bias; however, patient variables and outcomes were prospectively collected in electronic medical files in both centers, thereby limiting the influence of missing and/or inaccurate data. The modes of birth were not blinded, which may have influenced neonatal management in the Belgian center. The lack of formal long-term follow-up of babies in both centers limited the interpretation of the different protocols on future health.
Furthermore, the limited study population size may have reduced the possibility of detecting small differences in serious but less common outcomes in the 2 groups, although our results were comparable to previous publications.

**Practice implications**

Based on our work and other groups, VBD should remain a legitimate option, and this view is now supported by several international organizations, including the Royal College of Obstetricians and Gynaecologists, ACOG, CNGOF, and Society of Obstetricians and Gynaecologists of Canada. All organizations highlight the importance of clear management protocols and expertise in VBD to achieve optimal results.

With all this in mind, how do we now move forward in a practical way? First of all, the external cephalic version, which is safe and effective, should be universally available in all maternity units, regardless of local attitudes to VBD. Given that a good proportion of breech cases are first diagnosed in labor, the management of breech at term, including simulation, should be mandatory in every obstetrical training program, to reduce unnecessary and potentially dangerous emergency cesarean deliveries in the advanced stages of labor, which would be considered bad practice.

Centralization of resources and expertise can optimize outcomes, so we strongly support the development of regional breech centers capable of delivering most planned breech births at term in controlled environments, where continuous training and audits can guarantee a secure and high-quality service for motivated women. In a survey of obstetricians working in the 30 largest maternity units in Canada, 70% were willing to consider this possibility.27

**Conclusions**

Despite the apparent increases in short-term, nonserious adverse neonatal outcomes for the protocol, which includes the option of VBD, our results were relatively reassuring and supported the continuation of this option. Patient choice should be respected, and any possible excesses in minor morbidity must be balanced against increased maternal risks and the negative long-term effect on child health, which may accompany cesarean breech delivery. ■

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**Supplementary materials**

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.xagr.2022.100086.

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