J Gynecol Obstet Hum Reprod xxx (2018) xxx–xxx

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com

Original Article

# A case–control study about foetal trauma during caesarean delivery

Enora Dolivet [a,b,*], Cécile Delesalle [a,b], Rémi Morello [b,c], Marie Blouet [d], Corinne Bronfen [e], Michel Dreyfus [a,b], Guillaume Benoist [a,b]

[a] Department of Gynaecology, Obstetrics, and Reproductive Medicine, CHU (Centre Hospitalier Universitaire [University Hospital]), Côte de Nacre, 14000 Caen, France
[b] University of Caen Normandy, Esplanade de la Paix, 14000 Caen, France
[c] Department of Biostatistics and Clinical Research, CHU, Côte de Nacre, 14000 Caen, France
[d] Department of Paediatric Radiology, CHU, Côte de Nacre, 14000 Caen, France
[e] Department of Paediatric Surgery, CHU, Côte de Nacre, 14000 Caen, France

ARTICLE INFO

*Article history:*
Received 5 January 2018
Received in revised form 5 May 2018
Accepted 17 May 2018
Available online xxx

ABSTRACT

*Objective.* – The caesarean section rate is gradually increasing in most countries. The frequency of occurrence of foetal injury per birth is estimated to 1%. The majority of these injuries presents a low functional impact, but remains responsible for a significant neonatal morbidity. Even though the foetal risk factors are well documented in cases of vaginal birth, they have not been accurately identified for caesarean section.

The aim of this study is to identify the risk factors for neonatal fracture during caesarean section.

*Methods.* – We conducted a retrospective case–control study comparing complicated caesarean sections foetal fracture with uncomplicated caesarean sections in a tertiary teaching hospital. We collected all the caesarean sections carried out between 1st January 2003 and 1st September 2015 and selected those the medical files of which presented a foetal fracture diagnosis.

*Results.* – We identified 10 fractures during the study period, including four skull fractures, three long bone fractures, three clavicle fractures. In all these cases there were no complications with a median perspective of six years (median = 6, IQR = 4). The push method, which is performed during a caesarean section at the second stage of labour, is identified as a risk factor for foetal trauma in our study (OR: 20.2 [2.8–116.85], $p < 0.01$). A significant correlation was found between transverse lie and foetal trauma (OR: 16.67, CI [1.39; 123.18], $p = 0.0137$).

*Conclusion.* – Foetal trauma during caesarean delivery is a rare event for which the prognosis is most often favourable. Data in the literature on the subject are minimal. This study highlighted transverse lie and the push method as risks factors for foetal fractures during caesarean sections.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.



## 1. Introduction

Foetal traumas during delivery account today for 1% of all births [1]. Their consequences in terms of functional sequelae are generally limited, but their impact on neonatal therapeutic management and the length of stay in the maternity department are not negligible. The most frequently encountered fractures are fractures of the clavicle, the humerus, the femur, and the cranium [2]. Most of the risk factors for obstetrical trauma during vaginal delivery are known: instrument extractions [1], breech presentation, foetal macrosomia [2–7]. In contrast, traumatic foetal complications during a caesarean section have not been extensively studied. Some caesarean sections are even carried out so as to limit risk for traumas (foetal macrosomia, pelvic presentation). However, foetal extraction by caesarean section can be difficult and manoeuvre that entail risk of trauma are sometimes necessary.

Taking into account the increased rate of caesarean sections and the development of the indications, it is legitimate to investigate the frequency of foetal traumas after caesarean sections, and to assess the risk factors for these traumas. There are numerous descriptions of isolated cases in the literature [8–10], but to our knowledge, there is only one large-scale series (37,110 caesarean

* Corresponding author at: Department of Gynaecology, Obstetrics, and Reproductive Medicine, Caen CHU, Côte de Nacre, 14000 Caen, France.
*E-mail address:* enoradolivet@gmail.com (E. Dolivet).

https://doi.org/10.1016/j.jogoh.2018.05.002
2468-7847/

sections) descriptively analysing foetal trauma after caesarean births [11].

The objective of this case–control study was to identify the risk factors of neonatal trauma during caesarean birth in a French tertiary maternity department.

## 2. Methods

The study was a retrospective case control study carried out in a tertiary maternity department in a French university hospital centre performing between 3000 and 3200 deliveries per year, with a caesarean section rate ranging between 19% and 21% over the period of this study.

All the caesarean sections performed between 1st January 2003 and 1st September 2015 were listed in a computerised system. Cases for which a diagnosis of neonatal fracture was made were identified by using the PMSI (Programme de médicalisation des systèmes d'information [Information System Medicalisation Programme]) coding by means of code P13 (skeletal lesion due to obstetrical trauma). Multiple pregnancies, caesarean sections carried out before 32 weeks, and caesarean sections where the foetus died in utero (foetal death in utero or medical termination of pregnancy) were excluded from this selection. We also identified the cases of cephalhematoma (code P120), intracerebral haemorrhage (code P10) and plexus brachial (code P143) after caesarean deliveries with the same exclusion criteria during the period of this study.

The analyses were then carried out on the group of bone trauma only. So as to assemble a control group, we matched each case with 10% of the overall caesarean sections performed during the same year and with a gestational age of at least 32 weeks. We selected these 10% randomly.

In each of these two groups, the following variables were analysed after manual collection in the individual medical file: maternal age, body mass index (BMI), parity, emergency (during the labour or not) or scheduled nature of the caesarean section, cervical dilation at the time of the caesarean section, foetal presentation, obstetrical manoeuvres carried out for the extraction, gestational age in weeks of gestation completed, type of skeletal trauma (for the grouping of cases, by definition), the infant's birth weight (BW).

For each quantitative variable, the average and the standard deviation, the median and the first and third quartile were calculated. The Mann–Whitney test was used to compare these data. The qualitative variables were analysed by the Fisher exact test. For all statistical analyses, a $p < 0.05$ was considered to be significant ($p$-value, $\alpha = 5\%$) for a confidence interval at 95%.

## 3. Results

The total number of caesarean sections over the period of the study was 7930, 6840 of which corresponded to the criteria of inclusion (excluding multiple pregnancies and caesarean sections before 32 weeks). Ten new-borns presenting at least one fracture were identified, which is a prevalence of obstetrical bone trauma of 10/7930 caesarean section (1.26‰) (Table 1).

46 cases of cephalhematoma after caesarean delivery were identified over the period of the study, representing 82% of the foetal trauma after caesarean sections. Two cases of intra cerebral haemorrhage after caesarean section were identified. These two new-borns were also part of the group of bone trauma (skull fracture). No case of brachial plexux injury after caesarean delivery was identified.

The sample size of the control group was 348 subjects, which is a ratio of one case per 35 controls. Both groups presented no significant differences for the following variables: age, parity, BMI, term, and birth weight (Table 2).

In all the cases, the surgical method used was Joel-Cohen and it was the first choice of surgical method used for the entire staff in our obstetrical unit.

In five cases out of ten, there was a fracture of an upper limb, in four cases there was a skull fracture, and in one case, the fracture concerned a lower limb.

**Table 1**
Contexts and characteristics of the cases.

| No. | Context | Indication | CD[a] | GA[b] | Presentation | Manoeuvre | BW[c] | Type of fracture |
|---|---|---|---|---|---|---|---|---|
| 1 | Emergency | Bleeding (Placenta Previa) | 0 | 35 | Transverse | Suction cup | 2.470 | Clavicle |
| 2 | Scheduled | Uterus with two incisions | 0 | 39 | Cephalic | ICV + TBE | 4.330 | Clavicle |
| 3 | Emergency | Brow presentation | 3 | 40 | Cephalic | None | 3.150 | Humerus |
| 4 | Emergency | Stagnation of dilation | 8 | 39 | Cephalic | None | 3.270 | Humerus |
| 5 | Emergency | Failure of instrumental extraction | 10 | 38 | Cephalic | Suction cup-forceps before CS – pushing through vagina | 2.660 | Cranium |
| 6 | Emergency | Non engagement | 10 | 41 | Cephalic | None | 3.710 | Cranium |
| 7 | Emergency | Non engagement | 10 | 41 | Cephalic | Pushing through vagina-suction cup | 3.000 | Cranium |
| 8 | Emergency | Prolapsed umbilical cord | 3 | 32 | Transverse | TBE | 1.950 | Clavicle |
| 9 | Scheduled | Breech and macrosomia | 0 | 38 | Incomplete breech | TBE | 3.510 | Tibia-Fibula |
| 10 | Emergency | Stagnation of dilation | 7 | 41 | Cephalic | Pushing through vagina | 4.560 | Cranium |

ICV: internal cephalic version; TBE: total breech extraction.
[a] Cervical dilation in cm.
[b] Gestational age in week.
[c] Birth weight in kg.

**Table 2**
Clinical characteristics of the cases and of the controls.

| | With foetal fracture | | Without foetal fracture | | $p$ |
|---|---|---|---|---|---|
| | $m \pm SD$ | Med $[Q_1–Q_3]$ | $m \pm SD$ | Med $[Q_1–Q_3]$ | |
| Age (years) | 30.2 ± 3.76 | 29.5 [28.25–30] | 29.75 ± 5.76 | 30 [26–35] | 0.94 |
| Parity | 0.5 ± 0.85 | 0 [0–0] | 0.84 ± 1.09 | 1 [0–1] | 0.27 |
| BMI | 24.81 ± 5.98 | 22.1 [21.275–28.1] | 25 ± 5.95 | 23.3 [20.8–28] | 0.92 |
| Gestational age (weeks) | 38.4 ± 2.91 | 39 [38–40.75] | 38.46 ± 2.25 | 39 [38–40] | 0.77 |
| Birth weight in kg | 3.261 ± 0.808 | 3.210 [2.745–3.450] | 3.152 ± 0.708 | 3.260 [2.797–3.600] | 0.84 |

BMI: body mass index.

Please cite this article in press as: Dolivet E, et al. A case–control study about foetal trauma during caesarean delivery. J Gynecol Obstet Hum Reprod (2018), https://doi.org/10.1016/j.jogoh.2018.05.002