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Integrative Pediatrics

Risk Factors of Clavicle Fracture in the Newborns

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Abstract

Background: *The aim of the present study is to investigate the maternal and fetal predisposing factors of clavicle fractures in newborns.*

Methods: *A total of 75 clavicle fractures from 32.290 births were evaluated retrospectively at our hospital. The risk factors for fracture were determined and compared with a control group. The control group consisted of vaginally delivered term newborns.*

Results: *All newborns with clavicular fractures were born via vaginal delivery, while 20 of them were delivered via a vacuum extraction. 52 (69.3%) were males and 23 (30.7%) were females. Furthermore, 62 of the fractured clavicles (82.6%) were diagnosed by pediatricians and nurse. 13 (17.4%) were incidenatlly diagnosed during chest X-rays conducted for the evaluation of respiratory symptoms in newborns. Of the total 21 infants (28%) presented with symptoms of brachial plexus palsy and recovered without treatment. Maternal factors such as parity, age and height were statistically significant in the fracture group and the mothers in the fracture group were statistically significantly more likely to have undergone a vacuum delivery. The birthweight of the newborns and those with weights in excess of > 4000g were statistically significantly higher in the fracture group. An Apgar score < 8 in the first min and shoulder dystocia were also significantly more common in the fracture group.*

Conclusion: *Maternal age, parity, vacuum delivery and shoulder dystocia were found to be significant risk factors for clavicle fracture. However, there is no concensus analysis compare, revealed a lack of concencus on the factors affecting fracture.*

Keywords: *newborn, clavicular fracture, shoulder dystocia, brachial plexus palsy, birth trauma*

Introduction

Clavicle fractures in newborns are a frequent complication during the process of delivery with an incidence rate of 0.2 to 3.5% of all births [1-10]. The pathophysiology of clavicle fractures remains uncertain, although it is often suggested that such fractures results from compression of the fetal anterior shoulder against the maternal symphysis pubis [1]. Fractures usually heal without any complication or late sequelae, and, therefore, they are not considered to be a significant postnatal injury. In general, clavicle fractures are thought to be related primarily to vaginal deliveries as they are rare in cesarean section deliveries [11].

Clavicular fractures are also sometimes associated with shoulder dystocia. Previous studies have reported various risk factors for the occurrence of neonatal clavicular fracture during delivery, including birthweight, gestational age, Apperance, Pulse; Grimace, Activity and respiration (Apgar) score, shoulder dystocia, instrumental vaginal delivery maternal age and maternal height [1-9].

The aim in this study is to investigate the predisposing maternal and fetal factors of clavicle fracture in newborns.

Materials and Methods

A total of 75 clavicle fractures from 32.290 births between September 2016 and September 2018 were evaluated retrospectively at Department of Pediatrics, Diyarbakır Gazi Yaşargil Training and Research Hospital retrospectively. The diagnosis of a fractured clavicle was made incidentally from a chest X-ray or by the pediatricians and nurses during the hospital stay of the patient, and was based on upper extremity movement, crepitation, tenderness, and swelling of the affected shoulder. A radiography was performed in all fractured cases to confirm the diagnosis and an orthopaedic surgeon evaluated all plain films available for review.
The control group consisted of vaginally delivered term newborns whose birth immediately followed that of each the 75 newborns with a clavicular fracture.

Maternal factors including age, parity and, height, together with fetal characteristics such as gestational age, sex, birthweight, height, birthweight > 4000, shoulder dystocia and Apgar score at one and five min were considered and compared between the two groups. A written consent was obtained from each patient. The study protocol was approved by the Diyarbakır Gazi Yaşargil

Training and Research Hospital's Ethics Committee for this protocol (number 196) on 28.12.2018. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Statistical analysis

The two-sided statistical tests were performed using SPSS for Windows (version 20.0; IBM Corp., Armonk, NY, USA). For the comparative analysis between groups (case vs. control), a chi-square ($\chi 2$) test was used for categorical variables, and either the Student t test or a Mann-Whitney U test was used for the continuous variables. In the univariate analysis, differences were considered significant at a p value of < 0.05. For the identification of independent factors of clavicular fracture which could influence disposition, multivariable logistic regression analyses (polytomous responses) were performed to calculate the odds ratio (ORR) and the corresponding 95% confidence intervals (CI). A *p* value of <0.05 was considered statistically significant.

Results

Clinical features

Among 32.290 newborns delivered during the study period, 75 clavicle fractures were found, corresponding to an overall incidence of 0.23%. A total of 75 newborns with clavicular fracture were born via vaginal delivery, 20 of which were vacuum extractions. Of the total 52 cases (69.3%) were males and 23 (30.7%) were females and 62 cases (82.6%) of fractured clavicle were diagnosed by pediatricians and nurses based on decreased moro reflex, swelling, tenderness, and crepitation of the affected site. The remaining 13 cases (17.4%) were diagnosed incidentally during chest X-rays for the evaluation of respiratory symptoms in the newborns.

A total of 49 (65.3%) clavicle fractures were seen on the right side, 25 (33.3%) on the left side and one case was found to be bilateral (1.4%; Table 1). The diagnosis of 66 (88.0%) of the fracture cases occurred on the day of birth, eight cases (10.6%) were diagnosed on the second day and, one case (1.4%) was diagnosed on the third day. All of cases were identified prior to being discharged from hospital. Shoulder dystocia was detected in 52 (72%) patients with clavicle fractures. Furthermore, 21 infants (28%) presented with symptoms of brachial plexus palsy, such as weak and limited arm movement, but had benign outcomes with no sequelae.

All the patients with clavicle fractures recovered without any treatment, and with no neurological sequelae.

Analysis of risk factors

A total of 75 newborns with clavicular fractures were compared with a group of vaginally delivered newborns without fracture. Maternal factors such as parity ($p = 0.040$), age ($p = 0.003$), height ($p = 0.008$) were statistically significant in the fracture group and the mothers in the fracture group were significantly more likely to have undergone a vacuum delivery ($p < 0.001$). The birthweight of the newborns was significantly higher in the fracture group compared to the control group (3557 ± 625 g and 3237 ± 455 g, respectively) ($p < 0.001$). 18 newborns (24.0%) in the fracture group, which was a siginificantly higher number that the four newborns (5.3%) of that weight in the control group ($p = 0.001$). The Apgar scores of < 8 in first min were also significantly more common in the fracture group ($p = 0.016$) although there was no significant differences between the two groups with regard to the Apgar scores at the first and fifth min and Apgar score < 8 at fifth min (Table 2). Shoulder dystocia was statistically significant ($p < 0.001$). We selected eight variables with a p value of < 0.05 for the logistic regression model. In the multiple logistic regression analysis; maternal age, parity, vacuum delivery and shoulder dystocia were found to be the independent risk factors for patients diagnose with a clavicular fracture.

	n (%)
Sex	
Male	52 (69.3)
Female	23 (30.7)
Gestational age	
Preterm	2 (2.6)
Term	73 (97.4)
Side of fracture	
Right	49 (65.3)
Left	25 (33.3)
Bilateral	1 (1.4)
Vacuum delivery	20 (26.6)
Time of diagnosis	
First day	66 (88)
Second day	8 (10.6)
Third day	1 (1.4)
Cause of diagnosis	
Symptoms and exam	62 (82.6)
Incidental on X-ray	13 (17.4)
Brachial plexus palsy	21 (28)
Shoulder dystocia	54 (72)
Prognosis (complete recovery)	75 (100)

Table 1. Clinical features of clavicular fracture (*n* = 75)

	Fracture group Mean±SD or number (%) n=75	Control group Mean±SD or number (%) n=75	*p value*
Maternal age (years)	30.2 ± 5.6	27.4±6.0	**0.003**
Parity	2.6 ± 1.2	2.5 ± 1.1	**0.040**
Maternal height (cm)	161.4 ± 5.3	163.8 ± 5.3	**0.008**
Vacuum delivery, *n* (%)	20 (26.7)	1 (1.3)	< **0.001**
Sex male, *n* (%)	52 (69.3)	50 (66.7)	0.726
Gestational age (week)	38.4 ± 1.1	38.4 ± 0.7	0.868
Birthweight (g)	3557 ± 625	3237 ± 455	< **0.001**
Birthweight >4000 g, *n* (%)	18 (24.0)	4 (5.3)	= **0.001**
Birth height (cm)	50.1 ± 3.5	50.4 ± 1.5	0.511
Apgar score 1 min	7.8 ± 0.7	7.9 ± 0.5	0.197
Apgar score 5 min	8.9 ± 0.6	8.9 ± 0.4	1.000
Apgar score 1 min <8, *n* (%)	18 (24.0)	7 (9.3)	**0.016**
Apgar score 5 min <8, *n* (%)	2 (2.7)	1 (1.3)	0.580
Shoulder dystocia	54 (72.0)	3 (4.1)	< **0.001**

Table 2. Significant factors of clavicular fracture

Discussion

The clavicle is the most frequently fractured bone during delivery. Although most clavicle fractures require no treatment and have good prognosis, they may cause significant distress to the parents. The precise mechanism of clavicle fracture remains unclear although some authors have proposed that such fractures occurs as a result of fetal shoulder pressure on the mother's symphysis pubis during vaginal delivery, particularly in shoulder dystocia [1,2,10]. In our study, shoulder dystocia was found to have a statistically significant influence on the clavicular fractures. The rate of fractured clavicle during birth in our institution was 0.23%, which is consistent with the previously described range of 0.2 to 3.5% [8,12,15].

In our study, all clavicular fractures were detected and diagnosed within three days of birth. Hsu et al.[3] reported similar results in 85% of cases. Many cases were detected based on clinical findings such as decreased moro reflex, crepitation, tenderness, and swelling of the fracture site, or were incidentally diagnosed during chest radiographies taken when an infant presented with respiratory symptoms [1,4,20]. Ahn et al. [16] found that 13.8 % of patients were diagnosed after being discharged from hospital. Joseph and Rosenfeld [10] showed that a high number (38.9%) of neonatal clavicular fracture cases were diagnosed after discharge. In our study, all clavicle fractures were diagnosed before discharge from the hospital which highlights the importance of physical examination before discharge. Of the total cases in the study, 21 had brachial plexus palsy with limited movement of the wrist and arm, and these patients were closely followed in the outpatient department clinic, and had no sequelae.

Previous studies have a identified no significant correlation between maternal age and clavicular fracture. Turnpenny and Nimmo [14], however, reported a significant difference in clavicular fracture risk, when the maternal age coupled with multiparity were considered. Maternal height was not found to be of statistical significance in a study conducted by Lurie et al. [4]. In our study, advanced maternal age, parity and shorter height were found to have a statistically significant influence on clavicular fracture. However, we believe that the relationship between maternal height and symphysis pubis size merits further investigation.

In addition, previous studies reported a more frequent right clavicle involvement than left [1,3,5,10], which was attributed in some studies to the hypothesis that deliveries in the left occipital anterior position were more common, causing more pressure on the right anterior shoulder and a subsequent increased risk of fracture of the right clavicle during a vaginal delivery [1,3,5]. In the present study, the fractures of the clavicle were more often on the right side than on the left side.

Considering the formerly reported fetal and maternal risk factors correlated with the occurrence of clavicle fractures in vaginal deliveries, birthweight, low Apgar score, infant weight in excess of 4000 g, older maternal age, shoulder dystocia, and vacuum delivery were all considered risk factors. An Apgar score < 8 in the first min was shown to be significant whereas there were no significant differences in the first- and fifth-min Apgar scores in the fracture group. In other studies, however, this factor was not significantly different between the fracture and control groups [4,5].

In the present study, a logistic regression analysis revealed maternal age, parity, vacuum delivery and shoulder dystocia as significant risk factors influencing clavicular fractures. Ahn et al. [16] found that clavicle fractures are significantly associated with vacuum deliveries and birth weight. Lam et al. [17] revealed the independent risk factors of shoulder dystocia and vacuum delivery. In another study, Ozdener et al. [9] reported maternal age and birth weight as a risk factor. In a study by Gudmundsson et al. [18] a highly significant relationship was found between newborn birthweight and maternal height and the frequency of complications. Roberts et al. [19] revealed the independent risk factors as birthweight, shoulder dystocia and gestational age. It is not possible to predict most cases of fracture before birth, since most fractures occur in cases not identified by any of the studied parameters. It is difficult to reveal why our study, as well as previous studies, disagree in identifying risk factors for clavicular

fracture during birth although one contributory factor could be the different constituent population, while another could be statistical variance. As the reason why the risk factors could not be clearly stated in the studies, we believe that the abovementioned lack of consensus together with a lack of identifiable mechanisms of clavicle fracture during delivery.

Conclusion

In conclusion, our study results suggest that maternal age, parity, vacuum delivery and shoulder dystocia are significant risk factors for clavicle fracture. However, the mechanism of a clavicle fracture during labor has yet to be fully elucidated. We recommend further large-scale and long-term studies using homogeneous group of patients to establish a definite conclusion.

Conflict of Interest

All authors declare that there is no conflict of interest.

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