ORIGINAL ARTICLE

Upper limb birth trauma in a Jordanian population: a prospective study at King Hussein Medical Centre, Amman, Jordan

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Abstract

Objective: To determine the incidence of and the main risk factors related to upper limb injury at birth.

Methods: This prospective study was conducted at the King Hussein Medical Centre, Amman, Jordan, from October 2014 to May 2015, and comprised newborns. The probable predisposing factors for upper limb birth injury and their relation to injury were analysed. SPSS 17 was used for data analysis.

Results: Of the 5,030 live births, 5,003(99.46%) newborns were without and 27(0.54%) were with upper limb birth trauma (5.4 injuries per 1,000 live births). Moreover, 2,565(51%) were boys and 2,465(49%) were girls. Of the injured, 20(74%) patients had clavicle fracture, 3(11.1%) each had brachial plexus injuries and fractures to the humerus, and 1(3.7%) had olecranon fracture, translating into an incidence of 3.97, 0.6 and 0.2 per 1,000 live births, respectively.

Conclusion: Upper limb injury was not uncommon at birth. In most cases, such injuries were unpredictable and unpreventable.

Keywords: Birth trauma, clavicle fracture, brachial plexus injury, Jordan. (JPMA 66: 1422; 2016)

Introduction

Up to the 2000s, many reports were published describing the incidence, frequency and treatment of birth trauma injuries. Many of the authors expressed a hope that improved obstetric techniques, including the more frequent use of caesarean section (CS), might lower this incidence.[1,2] However, the available data has not substantiated this hope.

The prognosis of upper limb trauma in neonates is better than that of similar injuries in adults, owing to their lower soft tissue tension and greater capacity for tissue healing and remodelling. However, birth injuries can have ongoing effects.[3-7] Therefore it is important to consider the mechanism and development of the trauma. Early diagnosis after delivery is essential because prompt treatment can produce a better prognosis and final outcome. But the diagnosis of such lesions is not always easy in newborn patients because signs and symptoms are not always evident.

This study tried to find out whether obstetric injuries in the upper limb are still a common occurrence, because in our experience, birth injuries, particularly to the upper limbs, still appear to be relatively frequent in the Jordanian community, despite the huge development in prenatal care prevention programmes.

This study was planned to identify the incidence of various birth traumas of the upper limb; to understand the causes and predisposing factors related to the mother, infant and type of birth; to assess the evolution of various injuries and the degree of recovery in different patients; to identify the best treatment method and carry out short-term follow-up to assess prognosis; and to identify possible preventive measures. The study particularly considered birth trauma injuries representing a concern for orthopaedic surgeons, such as fractures and peripheral nerve lesions, especially those affecting the upper limb: fractures to the clavicle and humerus, brachial plexus injury, forearm and elbow fractures and dislocations.

Patients and Methods

This prospective study was conducted at the King Hussein Medical Centre, Amman, Jordan, from October 2014 to May 2015, and comprised newborn babies. Data was collected using a proforma, completed by an orthopaedic Resident, and included the following information: age of the mother, the number of previous deliveries, history of gestational diabetes mellitus (GDM), delivery method, type of presentation in cases of vaginal delivery (VD), use of forceps or vacuum, induction with oxytocin, healthcare professional (HCP) doing the delivery (doctor or midwife), gestational age, gender, weight, length, head circumference of the newborns, and the Appearance, Pulse, Grimace, Activity, and Respiration(APGAR) score in the first and fifth minutes after delivery.[3-7,8,9]

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Assessment of birth trauma was based on this information and a physical examination by a paediatrician. Cases in which an obstetric trauma was present in the upper limb at the moment of delivery were included. The total live-born population was therefore divided into two subgroups: newborns with and without upper limb birth trauma. Both of them were compared to identify possible factors that might influence the incidence of trauma.

Short-term follow-up was undertaken to assess the evolution of the trauma, the healing of the bone and the recovery of the limb function. Diagnosis of the specific trauma and later follow-up were based on physical examination and radiological study by plain radiography.

Variables including incidence and frequency of trauma were calculated for both populations. SPSS 17 was used for data analysis. Data was compared by Fisher's exact test. P<0.05 was considered statistically significant.

Results

Of the 5,030 live births included in the study, 5,003(99.46%) newborns were without and 27(0.54%) were with upper limb birth trauma translating into5.4 injuries per 1,000 live births. Besides, 2,565(51%) were boys and 2,465(49%) were girls.

Of the injured newborns, 20(74%) patients had clavicle fracture, 3(11.1%) each had brachial plexus injuries and fractures to the humerus, and 1(3.7%) had olecranon fracture, translating into an incidence of 3.97, 0.6 and 0.2 per 1,000 live births respectively.

In 16(80%) clavicle fractures and 1(33.3%) humerus fractures, the injury was not diagnosed at the time of delivery, and the patients were taken to the emergency orthopaedic clinic 5-10 days after discharge because of supraclavicular swelling or hypomobility in the injured limb. Another 3(15%) clavicle fracture cases were associated with pseudoparalysis in the ipsilateral upper limb.

Variables mentioned in previous studies as possible predisposing factors were evaluated for the group of newborns with upper limb birth trauma and their mothers (Table-1).

Maternal age distribution was as follows: 1(3.7%) mother was younger than 17 years, 8(29.6%) were aged 18-25 years, 14(51.9%) 26-35 years and 4(14.8%) were older than 36 years. The incidence of birth injury was statistically lowest for mothers aged 15-25 years (p=0.00, χ^2 test).

Regarding the number of previous deliveries, 7(25.9%) mothers were nulliparous and 20(74.1%) were multiparous; the difference was not statistically significant.

Table-1: Demographics of 27 newborns with upper limb injury.

Variable	Range	Frequency	Percentage	p*
Mother				
Age (years)	<17	1	0.2	0.81
	18-25	8	30	
	26-35	14	50	
	36-45	4	14.8	
Previous deliveries (n)	0	7	25.90	0.02
	1	6	22.20	
	2	7	25.90	
	3	5	18.50	
	>4	2	7.40	
GDM	Yes	4	14.80	0.06
	No	23	85.20	
Delivery				
Type	CS	3	11.10	0.46
	ID	3	11.10	
	VD	21	77.80	
HCP delivering	Doctor	11	40.70	0.46
	Midwife	16	55.60	
Child				
Gestational age (weeks)	32-34	0	0	0.00
	35-37	2	7.40	
	38-40	25	92.60	
Sex	Male	19	70.40	0.41
	Female	8	29.60	
Birth weight (g)	<1500	0	0	0.69
	1501-2500	2	7.40	
	2501-3500	8	29.6	
	3501-4000	12	44.4	
	>4001	5	18.50	

*Significant at p<0.05
CS: caesarean section
GDM: gestational diabetes mellitus
HCP: healthcare professional
ID: instrumental delivery
VD: (normal) vaginal delivery.

Of the 27(0.54%) mothers who had newborns with upper limb birth trauma, 4(14.8%) developed GDM and 23(85.2%) did not(p=0.060). In the healthy group, 4,938(98.7%) babies were born to mothers with no GDM (Table 2).

Of the injured, the presentation was cephalic in 24(88,9%) cases and breech in 3(11,1%) (p=1.000).

Caesarean section (CS) was required for 3(11.1%) births, while 21(77.8%) underwent normal VD and 3(11.1%) required forceps/vacuum (p=0.000). In the healthy group, 2,031(40.6%) required CS, 2,949(58.8%) underwent normal VD and 23(0.5%) required instruments.

In cases with upper limb birth trauma, 11(40.7%) babies were

Table-2: Comparisons between newborns with and those without upper limb birth trauma.

Variable	Range	Without upper limb trauma N=5003		With upper limb trauma N=27		p*
		Frequency	Percentage	Frequency	Percentage	
Mother						
Age (years)	Valid<17	0	0	1	3.70	0.00
	18-25	2568	51.30	8	29.60	
	26-35	2294	45.90	14	51.90	
	36-45	141	2.80	4	14.80	
Previous deliveries (n)	0	1457	29.10	7	25.90	0.05
	1	1262	25.20	6	22.20	
	2	997	19.90	7	25.90	
	3	667	13.30	5	18.50	
	>4	620	12.40	2	7.40	
GDM	Yes	65	1.30	4	14.80	0.00
	No	4938	98.70	23	85.20	
Delivery						
Type of delivery	CS	2031	40.60	3	11.10	0.00
HCP delivering	Doctor	2105	42.10	11	40.70	0.31
	Midwife	2898	57.90	16	55.60	
Child						
Gestational age (weeks)	32-34	25	0.50	0	0	0.00
	35-37	173	3.50	2	7.40	
	38-40	4805	96.00	25	92.60	
Sex	Male	2546	50.90	19	70.40	0.51
	Female	2457	49.10	8	29.60	
Birth weight (g)	<1500	172	3.40	0	0	0.00
	1501-2500	691	13.80	2	7.40	
	2501-3500	3240	64.80	8	29.6	
	3501-4000	689	13.80	12	44.4	
	>4001	211	4.20	5	18.50	
	I/D	23	0.50	3	11.10	
	V/D	2949	58.80	21	77.80	

*Significant at p<0.05.
CS: caesarean section
GDM: gestational diabetes mellitus
HCP: healthcare professional
ID: instrumental delivery
VD: (normal) vaginal delivery.

Table-3: Comparison of obstetric brachial plexus palsy and clavicle fracture in previous studies.[23,24]

Study	OBPP	Clavicle fracture
Rubin (1964)[23]	1.2/1000 (n=18)	2.7/1000 (Nn=43)
Gordon et al (1973)[25]	1.89/1000 (n=59)	-
Mendese (2004)[24]	-	7.0/1000 (n=726)
Our Study (2015)	0.6/1000 (n=6)	3.9/1000 (n=17)

OBPP: obstetric brachial plexus palsy.

delivered by a doctor and 16(59.3%) by a midwife (p>0.05).

Mean gestational age was 38.96 weeks (range: 37-41 weeks). In the healthy group, the mean gestational age was 38-40 weeks in 4,805(96%) cases. In the injured group, gestational age was more than 38 weeks in 25(92.6%) and 35-37 weeks in 2(7.4%) (p=0.000).

Moreover, 8(0.3%) of the overall female population and 19(0.77%) of the male population were injured (p=0.5).

In the injury group, the mean weight of the newborns was 3,378 g (range: 2,100-4,900 g). Distribution of birth weights was as follows: 2(7.4%) were in the range of 1,501-2,500 g, 8(29.6 %) in the range of 2,501-3,500 g, 12(44.4%) in the range of 3,501-4,000 g and 5(18.5%) weighed more than 4,000 g. There were significant differences between the groups, with the lowest incidence of birth injury in the upper limb seen for infants weighing 2,501-3,500 g (p=0.003) and the incidence of birth injury increasing with higher birth weight.

Discussion

Our study indicated that trauma to the upper limb still occurred in a significant number of births, and it was frequently not noticed for several days, particularly if the injury occurred to the clavicle and causes no other symptoms. All patients with upper limb birth trauma were treated conservatively.

We analysed a number of possible risk factors for upper limb injury at birth. The sex of the child appeared to have no effect. There was no difference in the rate of birth injury between nulliparous and multiparous women, and there was no association between the type of HCP (doctor or midwife) performing the delivery. Increased gestational age and delivery post-term have been suggested as risk factors as most cases of upper limb trauma occur in full-term newborns. However, in our study, 95.5% of uninjured babies were also born at full term. Higher maternal age is considered as a predisposing factor for upper limb birth injury,[3,4,10-12] with an increase in the frequency of the injuries especially in mothers aged between 26-35 years.

The bone that is most commonly fractured during birth is the clavicle. In the current study, the incidence of this injury was 3.98/1000 (0.40%), whereas the incidence in other recent studies ranged from 0.3% to 2.9%.[13-15] The large discrepancy between these reported rates may in part be explained by the fact that 40% of clavicle fractures are not identified until after the newborn has been discharged from hospital.[15-17] Similarly, in the current study, most of the cases presented to the emergency room because of supraclavicular swelling 7-10 days after discharge.

Despite the association in most cases with traumatic delivery due to obstetric causes, most clavicle fractures occur in normal newborns after uncomplicated deliveries, and so it is an unpredictable complication.[15-18] Birth weight is considered in many studies to be the most important risk factor for clavicle fracture in newborns. In our study, 75% of clavicle fractures were in newborns weighing over 3500 g, confirming the correlation between the two.

GDM is also considered a risk factor in many studies; in this study, 5.8% of mothers with GDM and 0.46% of mothers with no GDM had a baby with a birth trauma in the upper limb, whereas 98.1% of mothers with GDM had babies with no birth trauma. However, of the 20 patients with clavicle fracture, only three had a mother with GDM (associated with high birth weight), which is not in accordance with the results of some previous studies.[16]

Mode of delivery seemed to have no bearing on risk of injury, with 16 cases being normal VD, one case being CS and the other three cases being instrumental (vacuum) delivery (ID). Thus, the majority of the clavicle fractures occurred with normal VDs, which makes this injury difficult to predict, as reported previously.[16] A higher number of previous deliveries to the mother appear to decrease the probability of a newborn having upper limb trauma at birth.[15]

All of the newborns with clavicle fractures had cephalic presentation and none of them was a breech presentation, although breech presentation is considered a predictor of upper limb birth trauma.[18] Furthermore, many previous studies imply that obstetric clavicle fractures are unpredictable and unavoidable complications of normal births.[19]

The incidence of birth injury to the brachial plexus was 0.6 per 1000 live births in this study, while in other studies it was reported between 1.2 and 1.89 cases/1000[8-12] (Table-3). Some prospective studies report incidences clustering around 1-2 per 1000 live births, or lower if only severe injuries are counted[7,13,14,20,21] Many authors have expressed the hope that improved obstetric techniques, including more frequent use of CS, might lower this figure,[10-12] but both the available data as well as the results of our study have not substantiated this hope. Although 40.4% of all newborns were delivered by CS, two cases of brachial plexus palsy (BPP) still occurred with this mode of delivery. Hence, despite the large number of CS, birth trauma to the upper limb still occurred.

Most of the infants with brachial plexus injury weighed more than 3,000 g, but the number of macrosomic babies in the overall study population was 4.2%, and none of these had BPP, which implies a decrease in the number of macrosomic babies in our population. None of the newborns with BPP had a mother with GDM.

Brachial plexus injuries have a greater chance of association with clavicle and humerus fractures, as seen in our three cases of clavicle fracture with pseudoparalysis, probably because of similarities in the mechanism of all three injury types.[8,12] Elective CS provides some protection but does not completely eliminate the risk of brachial plexus injury.[10] Approximately 90% of brachial plexus injuries recover spontaneously, as was also seen in this study.[20] Prognosis is excellent if antigravity movement of the biceps and shoulder abductor is present by three months of age.[20] Initial treatment is normally conservative, and involves physical therapy with passive range-of-motion exercises.

Fractures of the long bones during birth are uncommon. The incidence of humeral fracture in our study was 0.59

per 1000, while in other studies the incidence is approximately 0.05/1000.[18] Risk factors include breech presentation, CS delivery and low birth weight.[22] The three cases of humerus fractures in this study were from normal VDs, and all with cephalic presentation. One infant was macrosomic, whereas the other two were within the birth weight range 3,500-4,000 g. All three were full term, and none had a mother with GDM, a finding that does not concur with the data from previous studies.[19,22]

Regarding the fracture pattern, one was a left mid-shaft oblique fracture, while the other two cases were spiral fractures. All occurred in the right arm.

Conclusion

Birth injury in the upper limb occurred more frequently than previously thought.

A number of predisposing factors have been suggested in previous studies, but, most of the newborns with such injuries did not have these risk factors and thus it is not possible to predict the likelihood of upper limb trauma for an individual patient. Increasing the number of CS did not decrease the incidence of the birth injury in the upper limb. History of birth injury in a prior pregnancy, presence of foetal macrosomia and maternal diabetes are the major antepartum risk factors for upper limb birth trauma, whereas other risk factors such as obesity, excessive gestational weight gain and post-date delivery did not appear to have a significant association.

Iatrogenic injuries, both temporary and permanent, may be unavoidable in certain circumstances and do not necessarily imply negligence or malpractice on the part of the provider, whether this is a midwife or a senior doctor.

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