

A Five-year Retrospective Study on Maternal Characteristics and Neonatal Outcomes of Clavicular Fractures in the Newborns: Another Piece of Reassurance

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Objectives: To compare the maternal characteristics and neonatal outcomes of clavicular fractures in the newborns with diagnosis made in the same admission after delivery versus that made in readmission; and to provide reassurance to parents and public that clavicular fracture in the newborn is a self-limiting condition with good prognosis.

Methods: All cases of newborns with fractured clavicles in a regional hospital during a 5-year period from 1 January 2006 to 31 December 2010.

Results: A total of 188 cases of newborns with clavicular fractures were identified. The overall rate of fractured clavicles in the newborns was 0.65%. The respective rates of fractured clavicles in the newborns after instrumental deliveries and Caesarean section were 3.41% (38/1116) and 0.05% (3/6140). Overall, 68% and 90% of the cases were diagnosed in the first 3 days and within 7 days after birth, respectively; 28% of the cases were diagnosed upon readmission; 20% did not have any physical signs. In our cohort, 6.4% (12/188) of the cases were complicated with Erb's palsy; all these recovered completely within 6 months. There was no statistically significant difference in the maternal characteristics (except use of oxytocin) between the group diagnosed in the same admission versus that diagnosed at readmission. There were statistically significant differences in the mean gestational age, mean birth weight, proportion of newborns with birth weight of 4000-4999 g, body length, Apgar score <7 at first minute, meconium-stained liquor, incidental diagnosis of fractures, physical signs of fractured clavicles, neonatal jaundice (NNJ), treatment for NNJ, sepsis, and duration of hospitalisation between the two groups. Almost all cases were assessed by orthopaedic surgeons. All cases recovered completely without any neurological deficits.

Conclusion: Clavicular fracture in the newborn is not an uncommon condition. Infants delivered by Caesarean section are not 'immune' to this birth trauma. The condition has good prognosis, regardless of whether the diagnosis is made in the same admission after delivery or at readmission. Parents should be reassured of the self-limiting nature of this condition.

Hong Kong J Gynaecol Obstet Midwifery 2014; 14(1):24-30

Keywords: Clavicle; Fractures, bone; Infant, newborn; Neonatal screening; Patient outcome assessment

Introduction

The clavicle is the most commonly fractured bone in the neonate during parturition¹⁻³. The incidence of clavicular fracture in the newborn is between 0.2% and 4.5%⁴. It should be differentiated from humeral fracture, shoulder dislocation, and brachial plexus injury^{5,6}. As such, the cause of this condition has not been precisely identified. There is no uniform method for screening for the condition in most hospitals, nor any recommended preventive measures recommended⁷. It is considered an unavoidable and often unpredictable event^{8,9}.

The risk factors for clavicular fracture in the newborn include heavy babies, birth length of >52 cm^{6,10-12}, shoulder dystocia^{10,11}, prolonged second stage in primiparous patients⁶, advanced gestational age⁶, mid-forceps deliveries¹², and level of inexperience of the obstetrician¹². Prematurity, vacuum extraction, abnormal fetal presentation, the weight and age of the mother, and maternal gestational diabetes have also been implicated¹³⁻¹⁶.

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However, the majority of clavicular fractures are an unpredictable complication, occurring in healthy newborns of normal sizes, who undergo apparently uncomplicated deliveries¹.

The diagnosis of clavicular fracture is usually made clinically and confirmed by plain radiographs. Physical signs include decreased movements of the ipsilateral arm, crepitus, palpable bony abnormality, discoloration of the fractured side, irritability and bruising over the affected shoulder. Non-displaced fractures may only be apparent after callus formation or when neonates are subjected to radiography, ultrasonography, or multiple physical examinations by trained examiners^{17,18}. Figure 1a shows the radiograph of a newborn with left-sided fractured clavicle taken on day 4, while Figure 1b shows the same patient with radiograph taken on day 18 with an obvious callus formation over fractured site.

According to Kayser et al¹⁷, ultrasonography is a satisfactory alternative to radiological assessment for diagnosing fractured clavicles in the newborns as it prevents radiation exposure of newborns. The sonographic criteria for diagnosing fractured clavicles in the newborns include interruption of hyperechogenic zone of the bone, steps, axial deviation, and visible periosteal lesions. Haematomas are an indirect sign of fractures.

Clavicular fractures heal spontaneously without any long-term sequelae¹⁹. Newborn clavicular fractures heal well because of high regenerative potential of the periosteum in the newborns. Healing usually occurs within

4 to 6 weeks²⁰. Nevertheless, these fractures are a cause of distress to both parents and health care providers. Up to 40% of the cases are diagnosed after discharge, and the reported frequency of clinically diagnosed cases during hospitalisation significantly underestimates the actual incidence¹⁸.

It has been suggested that the incidence may well be underestimated due to lack of a consistent policy for screening for the condition⁷. However, clavicular fractures in the newborns carry good prognosis, and the incidence does not reflect the quality of care⁴. Despite this, the incidence of the condition has been suggested as an indicator of quality control²¹. In view of its benign, self-limiting nature, invasive intrapartum management such as Caesarean section to lower its incidence is not advised⁷.

Clavicular fractures in the newborns have raised concerns among parents and the media, particularly, about the long-term consequences, both functional and cosmetic. The objectives of this study were: (1) to review a cohort of newborns with fractured clavicles and their mothers from a regional hospital; (2) to compare newborns diagnosed in the same admission with those diagnosed in readmission; and (3) to evaluate the effectiveness of screening newborns for fractured clavicles. With these local data, we hope to provide reassurance to parents and the general public by demonstrating that clavicular fracture in the newborn is a self-limiting condition with good prognosis.

Methods

The study was conducted in the Department of Obstetrics and Gynaecology of Kwong Wah Hospital where around 6,000 deliveries are performed per year. Provided there are no complications, postpartum women are usually discharged on day 2 if they have delivered vaginally, and on day 3 if they have delivered abdominally. All newborns are examined by midwives after delivery in the labour suite. They are then examined by physicians before discharge: by obstetric house officers, obstetric medical officers or paediatricians (if they were consulted for neonatal problems in the postnatal wards). From 9 July 2009 onwards, all newborns are screened by paediatricians before discharge. The diagnosis of clavicular fracture in the newborn is confirmed by X-ray unless the mothers refuse radiography. A postnatal follow-up is arranged for the mothers and the babies are followed by paediatricians and orthopaedic surgeons with interval X-ray.

All cases of clavicular fractures of the newborns were identified from Kwong Wah Hospital Monthly

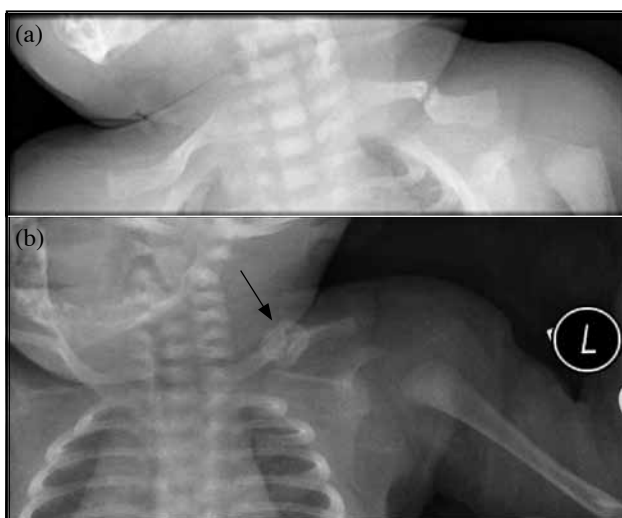


Figure 1. (a) Radiograph taken on day 4 of life showing the left-sided clavicular fracture. (b) Radiograph taken on day 18 of life showing an obvious callus (arrow) over left-sided fracture site

Perinatal Statistics during a 5-year period from 1 January 2006 to 31 December 2010. A retrospective analysis of the medical records of all women who had given birth to newborns with fractured clavicles was performed. The neonatal information was obtained via our Hospital Authority's computerised Clinical Management System. A 2-page data sheet was designed to collect maternal demographic data, birth data, and neonatal characteristics and outcomes. Post-term was defined as infant born after 40 weeks of gestation. Incidental diagnosis of fractures was defined as diagnosis made without any physical signs and when the fractures were noticed in X-rays taken for other purposes.

Statistical analysis was performed using the Statistical Package for the Social Sciences (Windows version 17.0, SPSS Inc., Chicago [IL], US). Chi-square test and Fisher's exact test were used for summarising categorical data. For continuous variables, descriptive statistics were calculated and reported as mean \pm standard deviation; means of groups were compared by using the Student's *t* test for independent samples. All tests were two-sided and considered significant at $p < 0.05$. The study was approved by the local research ethics committee.

Results

Overall, 188 cases of fractured clavicles were identified in the newborns from 2006 to 2010. During this period, there were 28,908 total live births in our unit including 1116 instrumental vaginal deliveries (1059 vacuum extraction deliveries and 57 forceps deliveries). From 2006 to 2010, the annual rates of fractured clavicles in the newborns were 0.34% (21/6232), 0.56% (30/5378), 0.63% (35/5515), 0.92% (53/5760), and 0.81% (49/6023). The overall rate of fractured clavicles in the newborns was 0.65%. The respective rates of fractured clavicles in the newborns delivered with the help of instruments and by vacuum extraction were 3.41% (38/1116) and 3.59% (38/1059) over 5 years. Two-thirds (127/188) of the cases were diagnosed in the first 3 days, while 90% (170/188) of the cases were diagnosed within the first week after delivery.

The maternal characteristics and outcomes are shown in Table 1. The majority (98.4%) of cases came from vaginal deliveries. Only three (1.6%) cases were delivered with Caesarean section; the first was an emergency Caesarean section for oligohydramnios and unfavourable cervix; the second and the third cases were elective Caesarean sections. All the fetuses were in cephalic presentation and delivered smoothly without any complications. Overall, 6,140 Caesarean sections

were performed from 2006 to 2010 in our unit; the rate of fractured clavicles in the newborns was 0.05% (3/6140) in this group.

The neonatal characteristics and outcomes are presented in Table 2. Over 97% of the cases delivered at term. Occipital anterior was the commonest birth position (93.1%). Most newborns (98.9%) had good Apgar scores at 5 minutes. Right-sided fractures were slightly more common than left-sided fractures (59.0% vs. 40.4%). Only one case was noted to have bilateral fractured clavicles. Nearly 80% of the cases were detected clinically by the

Table 1. Baseline maternal characteristics and outcomes (n=188)

Item	Mean \pm standard deviation or No. (%) of cases
Age (years)	32.1 \pm 4.6
≥ 35 years	61 (32.4)
Primiparous	96 (51.1)
Parity	
0	96 (51.1)
1	74 (39.4)
2	14 (7.4)
3	3 (1.6)
4	1 (0.5)
Previous macrosomia	12 (6.4)
Body mass index (kg/m ²)	21.8 \pm 2.9
Height (cm)	158.0 \pm 5.1
Pre-pregnant weight (kg)	54.6 \pm 7.5
Weight at delivery (kg)	69.9 \pm 8.5
Gestational diabetes	32 (17.0)
Mode of delivery	
Spontaneous vaginal delivery	147 (78.2)
Vacuum / forceps	38 (20.2)
Caesarean section	3 (1.6)
Epidural analgesia	7 (3.7)
Use of oxytocin	93 (49.5)
First stage (mins)	299.6 \pm 218.3
Second stage (mins)	28.6 \pm 32.6
Third stage (mins)	6.9 \pm 7.0
Prolonged second stage	37 (19.7)
Duration of range of motion (hours)	10.6 \pm 11.6
Episiotomy	138 (73.4)
Blood loss (mL)	379.7 \pm 415.1
Postpartum haemorrhage	25 (13.3)

presence of physical signs. The commonest signs were crepitus and decreased upper limb movements (Table 3). Most (95.7%) of the cases were assessed by orthopaedic

Table 2. Neonatal characteristics and outcomes (n=188)

Item	No. (%) of cases or mean \pm standard deviation
Sex	
Male	129 (68.6)
Female	59 (31.4)
Mean gestation (weeks)	39.2 \pm 1.2
Preterm (<37 weeks)	5 (2.7)
Post-term (>40 weeks)	84 (44.7)
Birth weight (g)	3500 \pm 430
4000-4999 g	20 (10.6)
\geq 4500 g	3 (1.6)
Head circumference (cm)	34.2 \pm 1.2
Body length (cm)	51.3 \pm 2.3
Birth position	
Occipital anterior	175 (93.1)
Occipital posterior	6 (3.2)
Occipital transverse	7 (3.7)
Apgar score <4 at 1 min	1 (0.5)
Apgar score <7 at 1 min	14 (7.4)
Apgar score <4 at 5 mins	0
Apgar score <7 at 5 mins	2 (1.1)
Meconium-stained liquor	48 (25.5)
Fractured side	
Right	111 (59.0)
Left	76 (40.4)
Bilateral	1 (0.5)
Anterior shoulder	134 (71.3)
Posterior shoulder	29 (15.4)
Incidental diagnosis of fractures	39 (20.7)
Physical signs of fractured clavicles	149 (79.3)
Decreased upper limb movement	58 (30.9)
Shoulder dystocia	8 (4.3)
Erb's palsy	12 (6.4)
Cephalohaematoma	8 (4.3)
Neonatal jaundice	92 (48.9)
Treatment for neonatal jaundice	77 (41.0)
Sepsis	63 (33.5)
Meconium aspiration syndrome	1 (0.5)
Assessed by orthopaedic surgeons	180 (95.7)
Duration of hospitalisation (days)	6.2 \pm 4.3

surgeons. Overall, 12 (6.4%) cases were complicated with Erb's palsy; all of these recovered completely within 6 months, either documented by paediatricians or orthopaedic surgeons, except one case who defaulted from follow-up as the mother had a non-eligible person status.

A total of 53 (28%) cases were diagnosed at readmission (readmission group). Figure 2 shows the number of cases plotted against the day of diagnosis for cases diagnosed in the same admission (same admission group) and readmission group. There was no statistically significant difference in maternal characteristics between two groups, except in the proportion of cases where oxytocin was used (54.8% in the same admission group vs. 35.8% in the readmission group; $p=0.019$). Table 4 shows statistically significant differences between the same admission and readmission groups in terms of mean gestational age, mean birth weight, mean body length, proportions of newborns

Table 3. Summary of physical signs in newborns with clavicular fractures (n=188)

Physical sign	No. (%)
Crepitus	59 (31.4)
Swelling	26 (13.8)
Tenderness	1 (0.5)
Decreased upper limb movement	58 (30.9)
Decreased Moro's reflex	2 (1.1)
Not specified	3 (1.6)
Absence of physical signs	39 (20.7)
Same admission	37
Readmission	2
More than one sign	31 (16.5)

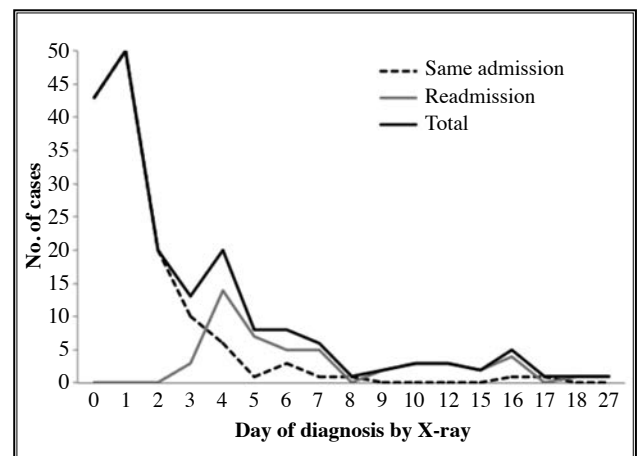


Figure 2. Graph showing the day of diagnosis in the same admission group, readmission group, and cases in total

Table 4. Comparison of neonatal characteristics and outcomes between the same admission and readmission groups

Characteristic	No. (%) of cases or mean \pm standard deviation		p Value
	Diagnosed in same admission (n=135)	Diagnosed at readmission (n=53)	
Male infant	92 (68.1)	37 (69.8)	0.825
Gestational age (weeks)	39.4 \pm 1.2	38.9 \pm 1.3	0.016
Preterm (<37 weeks)	3 (2.2)	2 (3.8)	0.622
Post-term (>40 weeks)	64 (47.4)	20 (37.7)	0.230
Birth weight (g)	3550 \pm 450	3380 \pm 350	0.006
4000-4999 g	19 (14.1)	1 (1.9)	0.016
\geq 4500 g	3 (2.2)	0	0.560
Head circumference (cm)	34.2 \pm 1.2	34.0 \pm 1.1	0.210
Body length (cm)	51.5 \pm 2.4	50.6 \pm 1.7	0.006
Birth position			
Occipital anterior	125 (92.6)	49 (92.5)	1.000
Occipital posterior	5 (3.7)	1 (1.9)	0.666
Occipital transverse	4 (3.0)	3 (5.7)	0.407
Apgar score <4 at 1 min	1 (0.7)	0	1.000
Apgar score <7 at 1 min	14 (10.4)	0	0.012
Apgar score <4 at 5 mins	0	0	-
Apgar score <7 at 5 mins	2 (1.5)	0	1.000
Meconium-stained liquor	41 (30.4)	7 (13.2)	0.015
Fractured side (right-sided)	78 (57.8)	33 (62.3)	0.611
Incidental diagnosis of fractures	44 (32.6)	2 (3.8)	<0.001
Physical signs of fractured clavicles	98 (72.6)	51 (96.2)	<0.001
Decreased upper limb movement	95 (70.4)	35 (66.0)	0.563
Shoulder dystocia	8 (5.9)	0	0.108
Erb's palsy	11 (8.1)	1 (1.9)	0.184
Cephalohaematoma	5 (3.7)	3 (5.7)	0.689
Neonatal jaundice	49 (36.3)	43 (81.1)	<0.001
Treatment for neonatal jaundice	46 (34.1)	31 (58.5)	0.002
Sepsis	57 (42.2)	6 (11.3)	<0.001
Meconium aspiration syndrome	1 (0.7)	0	1.000
Assessed by orthopaedic surgeons	129 (95.6)	51 (96.2)	1.000
Duration of hospitalisation (days)	7.1 \pm 4.5	3.5 \pm 1.8	<0.001

with: birth weight of 4000-4999 g, Apgar score <7 at first minute, meconium-stained liquor, incidental diagnosis of fractures, physical signs of fractured clavicles, neonatal jaundice (NNJ), treatment for NNJ, sepsis, as well as the mean duration of hospitalisation.

Discussion

The incidence of fractured clavicles in the newborns in our study is comparable with that reported

in the literature⁴. However, the incidence may well be underestimated. The reported incidence of Erb's palsy in the newborn ranges from 0.26-0.44%^{22,23} and that occurring in the group of newborns with fractured clavicles ranges from 1.7-9%^{6,24}. In our cohort, 6.4% of the cases were complicated with Erb's palsy; this rate is comparable with that reported in the literature.

The difference in the maternal characteristics

between the same admission and readmission groups did not reach any statistically significant difference, except for the use of oxytocin. The indications for the use of oxytocin include postdate pregnancies, maternal fever, suboptimal fetal heart tracings, and group B *Streptococcus* carrier with leaking, which explained the potential to be assessed by paediatricians and cared in paediatric ward.

Interestingly, there were three cases of fractured clavicles among newborns delivered by Caesarean section. There were no difficulties in the delivery of these fetuses. Thus, it seems that newborns delivered by Caesarean section are not 'immune' to fractured clavicles.

Over 60% of the affected newborns were male infants which echoed with data from previous studies^{7,10} stating that there was a male predominance for this condition. In this study, patients in the same admission group had significantly higher mean gestational age and greater mean body length than the readmission group. The proportion of cases with weight between 4000 and 4999 grams was also higher in the same admission group. These findings may be attributed to our routine practice of having a paediatric consult for all newborns with birth weight over 4 kg. The proportion of newborns with Apgar score <7 at 1 minute was also higher in the same admission group. These newborns were generally admitted in the paediatric ward for observation, thus increasing the chances of detecting fractured clavicles in this population. The same explanation applies for the statistically significant differences observed among newborns with meconium-stained liquor and sepsis. Physical signs of fractured clavicles become more obvious with time; this explains the significantly greater proportion of such cases in the readmission group than the same admission group. Maternal child health centre referred newborns with NNJ back to the hospital for further management and the newborns were, therefore, readmitted. This explains why the proportion of cases with NNJ and

those receiving treatment for NNJ were more common in the readmission group than in the same admission group. There were more cases of incidental diagnosis in the same admission group; this was an expected finding as physical signs of fractures were less developed in this group and X-rays were taken for other indications such as maternal fever, sepsis, etc. The duration of hospitalisation was shorter in the readmission group as the majority of newborns were readmitted for NNJ (43/53, 81.1%) and they are usually discharged after completion of phototherapy and improvement in NNJ.

Although there were statistically significant differences in the mean gestational age between the same admission group and readmission group, this was of no clinical significance. Compared with an earlier local study by Lam et al⁴ in 2002, the incidence of fractured clavicles in newborns delivered vaginally was significantly lower in our cohort (1.6% vs. 0.8%; $p < 0.001$) [Table 5]. However, the proportion of large-for-gestational-age fetuses between these two studies was not significantly different. Compared with the study by Lam et al⁴, there was a significantly lower proportion of instrumental deliveries (41.4% vs 20.2%, $p = 0.001$), both by vacuum extraction (34.4% vs 20.2%, $p = 0.027$) and with the help of forceps (6.6% vs 0.5% [1/188], $p = 0.011$) in our study. This may explain the lower incidence of fractured clavicles in the newborns in our cohort compared with that in the Lam et al's study⁴.

In this study, 6.4% of the cases were complicated with Erb's palsy and they all fully recovered within 6 months. To date, no long-term sequelae have been identified in these cases. As the callus resolves with time, there are also no cosmetic issues with fractured clavicles in the newborns. This indicates the good prognosis of fractured clavicles in the newborns even if these are complicated with Erb's palsy. Thus, reassurance should be provided to parents of newborns with clavicular fractures including

Table 5. Comparison between the present study and a local study in 2002⁴

Item	Lam et al 2002 ⁴	Present study	p Value
Year of study	July 1997 to June 2000 (4 years)	January 2006 to December 2010 (5 years)	-
No. of vaginal births	9540	22,480	-
No. of cases of fractured clavicles	153	188	-
Caesarean section	2 (1.3%)	3 (1.6%)	-
Vaginal delivery	151	185	-
Incidence of fractured clavicles (vaginal)	151/9540 (1.6%)	185/22,436 (0.8%)	<0.001
Large-for-gestational-age fetus (vaginal delivery)	31 (20.5%)	54 (29.2%)	0.069

those complicated with Erb's palsy.

Overall, 28% of the cases were diagnosed upon readmission. This group of cases is likely to raise concerns among the media and parents as diagnosis on readmission may be misinterpreted as 'missing the diagnosis' after birth. Special effort has to be made to explain the nature of this condition in the newborns and its expected outcomes. Our data would be useful for health care providers to counsel and reassure parents.

The limitations of our study include the relatively small sample size and the possible underestimation of the incidence of fractured clavicles in the newborns. Missing cases of fractured clavicles in the newborns may be attributed to readmission to other hospitals, discharge

from Accident and Emergency Department, or failure of detection.

Conclusion

Clavicular fractures in the newborns are not uncommon and can present upon readmission. Not all of them have detectable physical signs. Despite this, they carry good prognosis and heal completely without long-term sequelae. All our cases complicated by Erb's palsy recovered completely within 6 months. The prognosis of the condition is independent of whether it is diagnosed in the same admission after delivery or at readmission. However, clavicular fractures in the newborns do raise concerns among the media, parents, and health care providers. These concerns should be addressed and parents should be reassured about the self-limiting nature of the condition.

References

- Mavrogenis AF, Mitsiokapa EA, Kanellopoulos AD, Ruggieri P, Papagelopoulos PJ. Birth fracture of the clavicle. *Adv Neonat Care* 2011; 11:328-31.
- Glasgow LA, Overall JC Jr. The fetus and the neonatal infant. In: Ved Behrman RE, Vaughan CC III, editors. *Nelson textbook of pediatrics*. Philadelphia: WB Saunders; 1983: 360-1.
- Fraser FC. Miscellaneous disorders of the musculoskeletal system. In: Avery ME, Taeusch HW, editors. *Schaffer's diseases of the newborn*. Philadelphia: WB Saunders; 1984: 840-1.
- Lam MH, Wong GY, Lao TT. Reappraisal of neonatal clavicular fracture: relationship between infant size and neonatal morbidity. *Obstet Gynecol* 2002; 100:115-9.
- Oppenheim WL, Davis A, Growdon WA, Dorey FJ, Davlin LB. Clavicle fractures in the newborn. *Clin Orthop* 1990; 250:176-80.
- Gilbert WM, Tchabo JG. Fractured clavicle in newborns. *Int Surg* 1988; 73:123-5.
- Hsu TY, Hung FC, Lu YJ, et al. Neonatal clavicular fracture: clinical analysis of incidence, predisposing factors, diagnosis, and outcome. *Am J Perinatol* 2002; 19:17-21.
- Perlow JH, Wigton T, Hart J, Strassner HT, Nageotte MP, Wolk BM. Birth trauma. A five-year review of incidence and associated perinatal factors. *J Reprod Med* 1996; 41:754-60.
- Lurie S, Wand S, Golan A, Sadan O. Risk factors for fractured clavicle in the newborn. *J Obstet Gynaecol Res* 2011; 37:1572-4.
- Turnpenny PD, Nimmimo A. Fractured clavicle of the newborn in a population with a high prevalence of grand multiparity: analysis of 78 consecutive cases. *Br J Obstet Gynaecol* 1993; 100:338-40.
- Salonen IS, Uusitalo R. Birth injuries: incidence and predisposing factors. *Z Kinderchir* 1990; 45:133-5.
- Cohen AW, Otto SR. Obstetric clavicular fractures. A three-year analysis. *J Reprod Med* 1980; 25:119-22.
- Kaplan B, Rabinerson D, Avrech OM, Carmi N, Steinberg DM, Merlob P. Fracture of the clavicle in the newborn following normal labor and delivery. *Int J Gynaecol Obstet* 1998; 63:15-20.
- Beall MH, Ross MG. Clavicle fracture in labor: risk factors and associated morbidities. *J Perinatol* 2001; 21:513-5.
- Ohel G, Haddad S, Fischer O, Levit A. Clavicular fracture of the neonates: can it be predicted before birth? *Am J Perinat* 1993; 10:441-3.
- Many A, Brenner SH, Yaron Y, Lusky A, Peyser MR, Lessing JB. Prospective study of incidence of predisposing factors for clavicular fracture in the newborn. *Acta Obstet Gynecol Scand* 1996; 75:378-81.
- Kayser R, Mahlfeld K, Heyde C, Grasshoff H. Ultrasonographic imaging of fractures of the clavicle in newborn infants. *J Bone Joint Surg Br* 2003; 85:115-6.
- Joseph PR, Rosenfeld W. Clavicular fractures in neonates. *Am J Dis Child* 1990; 144:165-7.
- Nadas S, Reinberg O. Obstetric fractures. *Eur J Pediatr Surg* 1992; 2:165-8.
- Pecci M, Kreher JB. Clavicle fractures. *Am Fam Physician* 2008; 77:65-70.
- New York Department of Health Memorandum. *Fractured clavicles in newborns*. 1988; series 88/73:5.
- Levine MG, Holroyde J, Woods JR Jr, Siddiqi TA, Scott N, Miodovnik M. Birth trauma: incidence and predisposing factors. *Obstet Gynecol* 1982; 63:792-5.
- Peleg D, Hasnin J, Shalev E. Fractured clavicle and Erb's palsy unrelated to birth trauma. *Am J Obstet Gynecol* 1997; 177:1038-40.
- McBride MT, Hennrikus WL, Mologne TS. Newborn clavicle fractures. *Orthopedics* 1998; 21:317-20.