

A closed-claim analysis of complaints after paediatric antebrachial fractures

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ABSTRACT

INTRODUCTION: Antebrachial fractures in children (AFC) are common and account for one third of all paediatric fractures. The Danish Patient Compensation Association (PCA) receives complaints from patients who believe that they have sustained injuries due to potential malpractice or unfortunate circumstances. Case files on AFC from the PCA were assessed to identify causality and factors contributing to complaints and potential malpractice.

METHODS: A closed-claim analysis was performed in 138 cases with the diagnosis codes DS52.2 through DS52.6.

RESULTS: The most frequent complaints were fracture re-displacement ($n = 49$) and dissatisfaction with an otherwise correctly treated injury ($n = 30$). Doctor's delay due to missed primary diagnosis was found to be a median of 63 days. Complaints about surgery were almost equally distributed between K-wire and intramedullary nails, and unequally distributed for conservative treatment between splinting ($n = 29$) and casting ($n = 10$). Two thirds of the injuries were unacknowledged and evaluated as light injuries or no injury. One third of the complaints were acknowledged; the majority of which were both-bone fractures.

CONCLUSIONS: Two thirds of all complaints were due to normal fracture sequelae; thus, patient anticipation should be accommodated by thorough patient information. Mid-diaphyseal fractures of the forearm are overrepresented among the acknowledged complaints. Casting seems to be preferred to splinting. However, more awareness of these fractures using routinely performed radiographs at the first visit to the emergency room and at follow-up could avoid complaints as well as doctor's delay.

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Antebrachial fractures in children are the most common type of fractures, representing one third of all treated paediatric fractures [1, 2]. The number of this type of paediatric fractures is projected to increase in the future due to increased leisure time, access to recreational sports and early participation in elite sports [3]. The fractures occur throughout childhood, but are most commonly seen in the active teenage years [4-7]. Orthopaedic treatment is usually non-surgical with splint or cast treatment of undislocated fracture. For dislocated fracture, closed reduction and casting are performed

under full anaesthesia. For the more severe and unstable fractures, in some cases this is supplemented by internal fixation with intramedullary nails or K-wires until healing [8, 9]. Delayed or erroneous treatment has been claimed to cause sustained injuries and serious complications [10]. The aim of this study was to identify the causality and factors contributing to erroneous treatment of antebrachial fractures in children that lead to unsatisfactory treatment results for the child and parents. Using closed-claim analysis, this analysis is based on complaints and potential malpractice cases received in the Danish Patient Compensation Association (PCA). The PCA database contains information and analyses of filed claims from patients. We assessed the PCA database to analyse if an injury or an unexpected side effect is a result of medical treatment where an investigation and identification of potentially erroneous diagnostic processes or treatments have been performed. Our aim was to use the data and analysis results for secondary improvement treatment and to minimize any complications as in previous studies [5, 11].

METHODS

Data corresponding to each filed claim were made available from the PCA, including all antebrachial fractures in children with the diagnosis codes DS52.2 to DS52.6 filed from 1 January 2004 to 31 December 2009 in the PCA database. This included corpus radii fractures for single or both-bone fractures and distal fractures for single radius fracture or both-bone fractures. Data comprised medical journals, radiographic material and journal files including internal notes and any claims and compensation from the PCA relevant to the case. Moreover, all medical statements from the highly specialized medical consultants were made available. A closed-claim analysis was performed to identify potential recurrent patterns in treatment failures in general that might have motivated the patient and parents to file a claim [12]; data in all documents were examined and reviewed systematically. The following parameters were examined and analysed systematically for interrelatedness; age, gender, other diagnosis codes, complications, conducted procedures, level of competence of doctor responsible, degree of injury (Lex Maria), financial compensation and time line from the injury date to the closing of the claim.

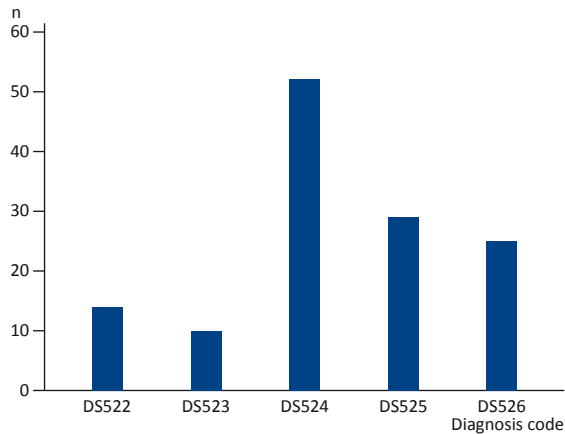
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FIGURE 1

The distribution of fracture types.



DS522: corpus ulnae; DS523: corpus radii; DS524: corpus ulnae + radii; DS525: distal radii; DS526: distal ulnae + radii.

TABLE 1

The distribution of types of complaints, in frequency order.

Code	Complication	Complaints, %
DT8130	Fracture displacement	32
DX010	Dissatisfaction with an otherwise correctly treated fracture	19
DX090	Missed diagnosis	16
DX020	Inadequate or improper surgery or treatment	8
DT812N	Unintended nerve lesion	6
DT921	Sequela fractura extremitatis superioris	5
DT814G+H	Dermal infection, post-operative	3
DT817K45+50	Thrombosis/embolism	3
DX000	No complication	2
DA480	Gas gangrene	1
DQ740J	Synostosis radio ulnaris	1
DS540	Lesion n. ulnaris	1
DT230B	Ambustio manus	1
DX005	Late surgery or treatment	1
DX008	Wrong implant or wrong handling of device	1
DX031	Another equal procedure preferable	1
DX050	No effect of surgery or treatment	1
DX097	Inevitable complication	1

The degree of injury was graded according to the Swedish 'Lex Maria' classification system, which assesses the severity of an injury [13]. All the closed claims were rated by the same reviewer from the PCA (including the Lex Maria score) to minimize interrater reliability.

Trial registration: not relevant.

RESULTS

Data retrieval from the PCA database yielded 153 closed claims initially. Twenty-three of these claims were excluded due to erroneous coding, since they were double-coded or pertained to a different type of fracture. This left us with a total of 130 closed claims for analysis. The boy-girl ratio was 1:2 with a mean age of 10.7 years (range: 3-15 years).

The fracture types were distributed as seen in **Figure 1**; one third of the complaints concerned both-bone fractures, which were only slightly fewer than the more common distal radius fracture. The latter fracture had a marginally higher number of complaints.

The overall distribution of complaints is presented in **Table 1**. The severe complications were seen in patients who suffered gas gangrene and nerve lesions in the fracture area; these were rare. Complications related to surgery were the most frequent complaints; and within this group, fracture re-dislocation in the post-operative period after surgery was the most frequently recorded complaint. Likewise, complaints of dissatisfaction with otherwise correctly treated fractures were frequent.

Complaints related to surgical procedures are presented in **Table 2**. The majority of complaints were seen in relation to closed reduction. The mid-diaphyseal and distal both-bone fractures were overrepresented. Moreover, 28 complaints concerned closed reduction with splinting and only ten cases concerned closed reduction with casting; the reason for complaining was related to secondary re-dislocation after the initial, apparently good reduction. The surgical method of using plates and screws was overrepresented with a high number of complaints.

Twenty-five complaints were related to *missed diagnosis*; the mid-diaphyseal fracture had the highest number of complaints (69%), and among these the mid-diaphyseal ulnae fracture was overrepresented (57%). The common distal fractures were represented in one third of the complaints (32%). This caused an average doctor's delay of 190 days for mid-diaphyseal fracture and nine days for distal fracture.

In general, the level of competence of the surgeon responsible for the treatment was evenly distributed among orthopaedic specialists and residents. The distribution of complaints was similar in the two groups.

Figure 2 illustrates the distribution of injury severity with 90% being rated as "minor injury", "inconsequential injury" or as "no injury" within the Lex Maria classification system. Ten percent were graded as "moderate or severe injury".

Two thirds of the closed claims were dismissed and considered normal fracture sequelae. One third of the closed claims were acknowledged. The majority of these

claims were mid-diaphyseal fractures, among which approximately half were acknowledged and regarded as a moderate injury (types 2 a and b). The received compensations ranged from no financial compensation to 65,684 USD (58,730 euro) with an average of 11,760 USD (10,433 euro). The claims that received the highest compensations concerned initially missed fractures, secondary loss of fracture correction and inadequate surgery.

A total of 34% of the complaints were not acknowledged and characterized as “no injury”. Cases of “dissatisfaction with an otherwise correctly treated fracture” were overrepresented in this group.

DISCUSSION

This study was a retrospective evaluation of closed claims from the PCA, including complaints after fractures of the lower arm in children. In general, two thirds of all closed claims are not acknowledged but considered to be without injury and are therefore assessed as normal sequelae after the fracture in question. In our opinion, this is too many complaints, and this should be accommodated by early written as well as oral information to the patient and their parents to clarify what they may expect in the course of “their fracture event”. However, one third of the complaints were acknowledged and categorized as moderate injuries. Missed fractures and loss of fracture correction were a major contributor to this category; initial radiographic analysis and secondary close radiographic follow-up may have prevented this, and should be recommended – based on our data. However, it would seem that certain types of fractures, types of treatment and also clinical “at risk signs” need closer attention when treating these fractures. The mid-diaphyseal fracture seems to cause erroneous treatment since it is overrepresented in the number of complaints and among acknowledged complaints. These fractures should be treated more cautiously. They were also overrepresented among complaints of missed diagnosis, especially the mid-diaphyseal fracture of ulnae, and special attention should be given to clinical examination for tenderness of in the middle of the lower arm, i.e. over the ulnae side. Radiographic examination should be performed if tenderness is registered at the primary health contact. In our opinion, this would avoid missed diagnoses with associated doctor’s delay. For the distal fractures, a doctor’s delay of nine days would seem acceptable since it would allow delayed reposition before full consolidation of the fracture. Fortunately, the doctor’s delay of 190 days for the mid-diaphyseal fractures does not reflect an actual delay from the fracture occurrence to the primary treatment, but was a systematic “bias” in the PCA [14]. This was namely defined as ‘timing’ according to when a secondary surgical procedure was

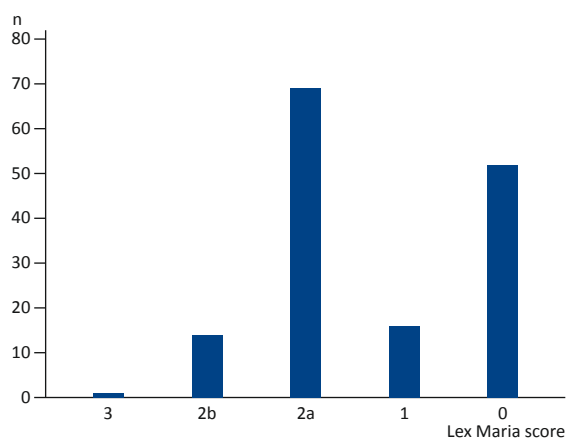
TABLE 2

Complaints related to the surgical procedure, in frequency order.

Code	Procedure	Complaints, %
KNCJ05	Closed reduction of distal radius	21
KNCJ06	Closed reduction of mid-diaphyseal of radius and ulna	14
KNCJ07	Closed reduction of distal ulna and radius	14
BLPA	Splinting of upper extremity	10
KNCJ66	Internal fixation of mid-diaphyseal radius and ulna using plates and screws	10
BLPA32	Splinting of hand and wrist	4
BLPC03	Casting of upper extremity	4
BLPC33	Casting of hand and wrist	4
KNCJ09	Closed reduction elbow/antebrachium non-specific	4
KNCJ15	Open reduction of distal radius	3
KNCJ46	Internal fixation of mid-diaphyseal ulna and radius using K-wires	3
KNCJ47	Internal fixation of distal ulna and radius using K-wires	3
KNCJ51	Internal fixation of mid-diaphyseal ulna using medullary nail	3
KNCJ56	Internal fixation of ulna and radius using medullary nail	3

FIGURE 2

Severity of the injury according to the Lex Maria classification system.



0: no injury; 1: inconsequential injury; 2a: minor injury; 2b: moderate injury; 3 severe injury.

performed, and thus not quite representative, but indicating that additional surgery was needed in cases where an attempt was made to achieve a good result for the mid-diaphyseal fracture. However, a delay in diagnosis would, in principle, influence the child’s later functional level and be associated with a higher risk of infection, growth disturbance and nerve damage due to surgery being performed on a healed or healing fracture.

Ensuring a higher level of knowledge among doctors working in the front line of the emergency department would likely yield more adequate and timely treatment. However, the level of competence did not seem to influence either the distribution or the number of complaints. However, this may also reflect that the specialists are involved in the more serious fractures than the residents, but we were unable to uncover the specialist role in the treatment specifically from the PCA database. This could also (and probably) reflect the fact that the surgical approach chosen is more important than the level of the doctor's competence; based on our data one should choose a method of fixation to prevent re-dislocation, i.e. introduce a lower threshold for insertion of K-wires to enhance the stability in closed repositioning procedures. On the other hand, there has been a trend in the management of children's lower arm fractures towards surgical stabilization due to the risk of re-displacement. Nevertheless, there is also a 14% risk of iatrogenic complications in the form of radial nerve palsy (2.2%) and skin irritation (7.8%). The benefit of surgical reduction should be weighed against the risk of complications and the natural, spontaneous tendency to remodel, which might be more prolonged than most treating physicians generally expect, e.g. that remodelling occurs up till five years after the initial injury [14, 15].

In our study, it would seem that splinting gives rise to additional complaints compared with casting. Casting is a more stable fixation [16] that is also more tedious to apply, but apparently worthwhile and to be preferred to splinting. Maybe setting the bar for casting instead of splinting lower even for the apparently stable fractures would improve treatment results. Moreover, improvement of the splinting/casting technique would also add stability to the "cast/fracture" construct, thus minimizing the number of complaints. This could be achieved by either specialist supervision or by providing special training for these procedures in a special simulation training tool [17].

In the post-operative period, fracture re-displacement was the single largest cause of complaints. Therefore, the fracture should be observed thoroughly throughout the treatment period for any fracture re-displacement, which should be considered an "at risk sign".

Noticeably, we recorded a relative overrepresentation of females, which we find remarkable as male gender is typically overrepresented in this population of fractures since boys have twice the risk of sports-related fractures, thus having 50% increased likelihood of sustaining a fracture before the age of 16 years compared with girls [3]. This may indicate that female gender is more sensitive to cosmetically displeasing, but functionally insignificant deformity or rather a parental concern

in regards to an apparent deformity. Could this warrant a more aggressive treatment protocol for girls? We will leave the question unanswered.

We acknowledge that our conclusions are based on a selective cohort and that a larger prospective cohort would be more representative. However, the demographics of the data from the PCA were in line with those of similar studies with a stronger design, except for the boy:girl distribution. However, this study is important since the number of dissatisfied patients probably is higher than we have seen in the PCA database. Earlier studies have estimated that only 2% of dissatisfied patients file a complaint [18]. Furthermore, in a similar study it was shown that delayed diagnosis of other paediatric orthopaedic and similar diseases is harmful for the patient in the long term [14].

Finally, it would also seem that the consequences of such lower-arm fractures in children are not severe, thus graded in the lower range of the Lex Maria scale; hence, for example, one third of the complaints were due to fracture displacement, but the consequences according to the Lex Maria scale were small. Furthermore, even if we optimize the treatment, it would still leave a number of cases of dissatisfaction, which is reflected in the number of complaints in otherwise correctly treated fractures for which no compensation was awarded. This may reflect that social expectations are higher today than previously and that initially perfect cosmetic and functional results are expected, resulting in parental dissatisfaction and subsequent litigation as seen in our study [15].

CONCLUSIONS

In conclusion, two thirds of the complaints concerning antebrachial fractures in children were groundless; thus, there are too many complaints and our results warrant more thorough patient information about "what to expect". Routinely performed initial radiographs may help avoid complaints after lower-arm trauma in children as may also secondary close radiographic follow-up after initial satisfactory fracture treatment. The mid-diaphyseal fractures are susceptible to more complaints, casting is preferred to splinting and fracture re-displacement is an "at risk sign". The health consequences of children's lower-arm fractures are not severe.

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