The acute first-time anterior shoulder dislocation (AFASD)
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Chapter 4

The acute first-time anterior shoulder dislocation in children and elderly patients
4.1 First-time anterior shoulder dislocations in children

Introduction
Traumatic dislocation of the glenohumeral joint in young children is rare. In none of the ancient writings of Hippocrates and Galen this injury is specifically mentioned as a typical injury in children. Even contemporary textbooks dealing with shoulder problems in children do not mention traumatic glenohumeral dislocation. By contrast; children are more likely to sustain a fracture of the proximal humeral epiphysis (type Salter Harris II). A review of the literature on this subject only revealed a few documented cases of glenohumeral dislocation in children. The reports vary from case reports (3x) to retrospective descriptive studies (5x), which describe the case management of a small number of children with a traumatic dislocation of the glenohumeral joint. We found three further case reports on fracture dislocation of the proximal humerus. However, atraumatic dislocation or subluxations of the glenohumeral joint are undoubtedly more common in both children and adolescents. Therefore one should differentiate between traumatic and atraumatic causes of shoulder dislocations in children as is the case with for example general laxity (Ehlers - Danlos disease) or voluntary dislocations.

Management of the first-time anterior dislocation of the shoulder is similar to the standard treatment (of this type of injury) in the adult patient. According to the literature, the recurrence rate of traumatic dislocation of the shoulder in children varies from 0 to 100%. It is apparent that the rates are extremely high in the group of adolescents.

Review of literature
Rowe (1956) found in his series of 500 acute shoulder dislocations only six children between 0 and 10 years and 49 children between 11-20 years. The youngest child with a shoulder dislocation was only six months old. The recurrence rate in children aged between 1-10 was 100%, while the recurrence rate in children aged between 11-20 was 94%.

Heck (1981) published a case report of an anterior dislocation of the glenohumeral joint in a 7-year old boy. At follow-up two years after the injury, he had no recurrent dislocation.

Wagner and Lyne (1983) found in their series of 212 traumatic first-time anterior shoulder dislocations ten shoulder dislocations in nine children with an open epiphysis in the period 1965 through 1979 at the Henry Ford Hospital in Detroit. All of these children were older than 12 years (range 12-16), with a mean age of 13.5 years. There were six boys and three girls (ratio 2:1). The injuries were caused by high school athletics in seven out of the nine children.
Recurrences occurred in eight of the ten patients with an anterior shoulder dislocation. The number of recurrences ranged from 1 to 50. Four of the eight patients had only one recurrence. The time interval between the initial dislocation to a recurrent dislocation varied from three to 18 months with a mean of 11 months. Seven patients underwent an open stabilisation procedure of the shoulder with an average of 28.1 months (range 8-20 months) after the initial dislocation.

Marans and Angel (1992) reported the largest documented series of this injury to date. In the period between 1975 and 1990 they found 21 traumatic first-time anterior shoulder dislocations at the Adelaide Children's Hospital and the Hospital for Sick Children in Toronto. The 21 children included 15 boys and 6 girls (ratio 2.5:1). Fourteen children (66%) were injured during sports activities. The mean age at the time of dislocation was 13 years (4-16). Three out of 21 patients were younger than 10 years. The follow-up of this study was carried out with a mean of 6.5 years (7-165 months). The interval time between the initial dislocations to the follow-up was 80 months (7-165 months) on average. At follow-up all children had sustained one or more recurrent dislocations. The mean time to the first recurrence was eight months (2-36 months). The children had an average of five recurrences (range: 1-11 recurrences).

Thirteen children (62%) underwent an open anterior stabilisation procedure. The operations were carried out with a mean of 25 months (range 4-36 months). In the case of the other eight children the operative treatment was delayed. Almost half of the children were treated with complete immobilisation in a sling and triangular bandage for six weeks. The other children had no immobilisation. The recurrence rate for the whole group was 100%, so immobilisation for six weeks did not alter the natural history of recovery in these children.

Endo and Kasai (1993) reported two cases of traumatic first-time anterior shoulder dislocations in a 3-year old boy and a 9-year old boy with short follow-up (1- and 2-year follow-up). Both children had no recurrent dislocation. In the period 1994-1995 Elbaum et al. (1994) found nine children/adolescents with a mean age of 14.4 years (range: 9-15) with a traumatic dislocation of the shoulder. There were four boys and five girls (ratio 1: 1.25). The follow-up time was minimally two years after the injury. The recurrence rate was 71%.

Kawaguchi et al. (1998) reported the first case history of a child (a 7-year old boy) with a delayed diagnosis of a first-time anterior dislocation of the shoulder that required an open reduction after two attempts of closed reduction. On inspection during the operation, no lesions to the humeral head or glenoid were found. The author did not describe the aspect of the labrum, capsule, and ligaments.

Recently, Postacchini et al. (2000) published their retrospective descriptive study of 780 patients who were treated for first-time anterior shoulder dislocations between 1988 and 1992.
Thirty-three patients (4.3%) were aged between 12 and 17 years at the time of the dislocation. They evaluated 28 of these 33 patients. There were 23 males and 5 females and they were subsequently followed-up. The mean age was 15.5 years at the time of the first-time dislocation. The mean follow-up was 7.1 years (range 5.5 to 8.9 years).

In the group with traumatic first-time dislocations (n=21), the rate of recurrences was 92% and the mean amount of recurrences was seven in the patient group of 14-17 years of age. All of the patients who underwent imaging studies were found to have Bankart lesions. In the patient group of 13 years of age or less (n=3) the recurrence rate was 33%.

Postacchini et al. hypothesised that this might be due to elasticity of the articular capsule and the glenoid labrum, which is greater in children than in older patients. Therefore, permanent lesions after trauma are less likely in the young.

Apparently, only 34% of the patients who were between 12 and 22 years old at the time of the primary dislocation had undergone surgery during the follow-up period due to persisting instability.

Te Slaa et al. (2003) found in their series of 133 first-time anterior dislocation of the shoulder only four patients who were younger than 18 years. The average age was 17.4 years. The youngest two patients were 16 years old. All were boys. Two were right-handed. There were no fractures and nerve injuries. The recurrence rate was 50%. The two 16-year old patients had a recurrence.

On reviewing the literature we found only 14 patients who were younger than 10 years of age at the time of the dislocation. The recurrence rates vary from 0% to 100%. In one case the recurrence rate was not mentioned. We should mention that in the 3 cases with no recurrence the follow-up had only been short (< 2 years). Furthermore, we have not been able to find reports in current literature about fractures of the greater tuberosity or nerve lesions in the young child with a first-time anterior dislocation of the shoulder.

Conclusions
First-time anterior shoulder dislocation is a rare pathology in paediatric traumatology. The recurrence rate in the adolescents group is higher than in the adult population. The pathoanatomy in the young child (< 16 years) based on arthroscopic studies has apparently not been described as yet, since we were consequently unable to find literature on this subject. However, some authors have suggested that in 80% of the adolescents there is a Bankart lesion. Arthroscopy of the shoulder for the purpose of diagnosis or treatment of acute first-time shoulder dislocation in “young” children has not been described in the literature.
Table 1. Review of articles on traumatic anterior first-time shoulder dislocations in children.

<table>
<thead>
<tr>
<th>Author</th>
<th>Article</th>
<th>Number of cases</th>
<th>Age</th>
<th>Sex ratio m:w</th>
<th>Recurrence rate</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rowe 1956</td>
<td>retrosp desc</td>
<td>6</td>
<td>1-10</td>
<td>ND</td>
<td>100%</td>
<td>ND</td>
</tr>
<tr>
<td>Heck 1981</td>
<td>case rep.</td>
<td>49</td>
<td>11-20</td>
<td>ND</td>
<td>94%</td>
<td>ND</td>
</tr>
<tr>
<td>Wagner 1983</td>
<td>retrosp desc</td>
<td>1</td>
<td>7</td>
<td>1:0</td>
<td>0%</td>
<td>ND</td>
</tr>
<tr>
<td>Marans 1992</td>
<td>retrosp desc</td>
<td>9</td>
<td>13.5 (12-16)</td>
<td>2:1</td>
<td>80%</td>
<td>7 of 9</td>
</tr>
<tr>
<td>Endo 1993</td>
<td>case rep.</td>
<td>21</td>
<td>13 (5-16)</td>
<td>2.5:1</td>
<td>100%</td>
<td>13 of 21</td>
</tr>
<tr>
<td>Elbaum 1994</td>
<td>retrosp desc</td>
<td>2</td>
<td>3 and 7</td>
<td>2:0</td>
<td>0%</td>
<td>none</td>
</tr>
<tr>
<td>Kawaguchi 1998</td>
<td>case rep.</td>
<td>9</td>
<td>12.4 (9-15)</td>
<td>1:1.25</td>
<td>70%</td>
<td>2 of 9</td>
</tr>
<tr>
<td>Postacchini 2000</td>
<td>retrosp desc</td>
<td>28</td>
<td>15.5 (12.0-17.0)</td>
<td>23:5</td>
<td>92%</td>
<td>7 of 28</td>
</tr>
<tr>
<td>Te Slaa 2003</td>
<td>retrosp desc</td>
<td>4</td>
<td>17.4 (16.4-17.9)</td>
<td>4:0</td>
<td>50%</td>
<td>none</td>
</tr>
</tbody>
</table>

Case rep. = case report
Retrosp des = retrospective descriptive study
ND = not documented
The acute first-time anterior shoulder dislocation in elderly patients

References

4.2 Anterior shoulder dislocations in elderly patients

Introduction
It is generally assumed that shoulder dislocations are mostly found in young patients. However, primary dislocations of the shoulder occur equally often before and after the age of 45 years. Recurrence of dislocation is not the primary complication in the elderly patient after an acute first-time anterior shoulder dislocation as is the case with young patients. Toolanen et al. reported that 47% of the patients had significant shoulder complaints three years after a shoulder dislocation because of rotator cuff tears and/or nerve injuries. Rotator cuff injury results in a prolonged morbidity and contrary to what is generally assumed, it is more common after a first-time shoulder dislocation in the elderly. In this chapter we will discuss the associated injuries: the rotator cuff tear, nerve lesions, adhesive capsulitis and greater tuberosity fractures in the elderly patient with an anterior shoulder dislocation.

Rotator cuff rupture
Rupture of the rotator cuff is a well-documented complication of an anterior shoulder dislocation in the middle-aged and elderly patient. Codman (1934) was one of the first authors who described the correlation between anterior shoulder dislocation and rotator cuff injury. The incidence of rotator cuff tear after acute dislocation in patients older than 40 years ranges between 35%-86% (Table 2). However, we should keep in mind that there is still a patient population that had (asymptomatic) rotator cuff tears prior to sustaining a shoulder dislocation. Milgrom et al. (1995) showed that rotator cuff changes such as a partial tear or full thickness rotator cuff tears have an increasing prevalence in asymptomatic adults older than 50. These tears were present in more than 50% of dominant shoulders in patients in their 70’s and in 80% of patients over 80 years of age. Milgrom et al. stated that rotator cuff lesions are a natural correlate of ageing. The same was seen in the control group (volunteers) in the study of Berbig et al. (1999).

Neer (1990) found evidence of a rotator cuff rupture in 30% of the patients older than 40 who sustained a first-time anterior shoulder dislocation. In the above-mentioned group Neer found that a tear might either extend from a pre-existing "impingement tear" in the supraspinatus or result from a longitudinal tear in the rotator interval extending in the subscapularis tendon. In elderly patients the extension of the former tear is often quite massive, leading to marked instability through the "posterior mechanism".
Ribbans et al. (1990) reported 63% rotator cuff ruptures due to a primary shoulder dislocation in a small number of patients older than 50 years. On the basis of clinical examinations, Hawkins and Mohtadi (1991) found clinically an incidence of 90% rotator cuff ruptures in patients older than 40 years of age. However, the documented incidence was lower in ultrasonographic, arthropgraphic, and arthroscopic studies. Reeves (1969) found 27 rotator cuff ruptures, confirmed by arthrography, in 47 patients with an acute first-time anterior shoulder dislocation (57%).

Toolanen et al. (1993) reported in their prospective ultrasonographic study of 65 patients older than 40 years of age a rotator cuff rupture rate of 38%. Forty-seven percent of the patients had significant shoulder complaints 3 years after the dislocation. However, 65% of their patients had an electromyogram confirmed nerve injury, which may have contributed to the high percentage they found.

Berbig et al. (1999) found in their prospective controlled study of 167 primary traumatic anterior shoulder dislocations with early ultrasonographic evaluation in 31.7% of the cases a full-thickness rotator cuff tear. The risk of a rotator cuff tear after a dislocation is increased in patients older than 40 years. (Table 1)

Table 1. Age distribution and full-thickness tears in 167 patients with AFASD

<table>
<thead>
<tr>
<th>Age</th>
<th>Dislocation</th>
<th>Full-thickness tears</th>
<th></th>
<th></th>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-19</td>
<td>14</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>20-29</td>
<td>19</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>30-39</td>
<td>19</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>40-49</td>
<td>14</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>50-59</td>
<td>19</td>
<td>1</td>
<td>5</td>
<td>-</td>
<td>6</td>
<td>32</td>
</tr>
<tr>
<td>60-69</td>
<td>23</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>11</td>
<td>48</td>
</tr>
<tr>
<td>70-79</td>
<td>32</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>17</td>
<td>53</td>
</tr>
<tr>
<td>80-89</td>
<td>24</td>
<td>1</td>
<td>4</td>
<td>10</td>
<td>15</td>
<td>63</td>
</tr>
<tr>
<td>90-99</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>167</td>
<td>4</td>
<td>25</td>
<td>24</td>
<td>53</td>
<td>32</td>
</tr>
</tbody>
</table>

(Berbig R. Primary anterior shoulder dislocation and rotator cuff tears. J Shoulder Elbow Surg. 1999.)
Neviaser et al (1993) reported a 100% rate of rotator cuff tears in patients older than 40 years with an AFASD. However, this was a pre-selected group of patients. They also reported a 30% recurrence rate. All patients with an anterior instability had ruptured the subscapularis tendon and the anterior capsule of the lesser tuberosity.

The study of Pevney et al. (1998) showed that 35% of the patients (18 out of 52) with an acute first-time anterior shoulder dislocation who were older than 40 years had a rotator cuff rupture. Only 67% of the patients with an isolated cuff rupture obtained an excellent or good result. This is in contrast with the patients without rotator cuff pathology who had a 100% excellent or good result. The patients with a rotator cuff rupture who were treated operatively had 84% excellent/good results, whereas patients who were treated non-operatively only had 50% excellent/good results. These results as well as the results of others support the need for early diagnosis and subsequent surgical treatment of rotator cuff ruptures after a shoulder dislocation. Recently, Robinson et al. (2002) reported their three-year prospective, observational cohort study of 538 consecutive patients with a first-time anterior shoulder dislocation. The average age was 47.5 years (13-97). They found an early redislocation rate of 3.2% within the first week after the initial dislocation. In general this redislocation occurred predominantly in middle-aged and elderly individuals. Acute instability after anterior dislocation appears to occur in association with either severe disruption of the capsulolabral complex and rotator cuff envelope or fractures that compromise the normal osseous restraints to dislocation. In this study 13.4% of the patients (n=72) had a rotator cuff tear. The average age of these patients is 66.2 years. Six out of the 72 patients (8.3%) had a redislocation. The presence of a rotator cuff tear is therefore associated with a much higher risk of redislocation. (relative risk = 29.8%) Satisfactory results were obtained after early operative (cuff) repair.

Table 2. Prevalence of rotator cuff tears with shoulder dislocation.

<table>
<thead>
<tr>
<th>Author</th>
<th>Patient age</th>
<th>Patients (n=)</th>
<th>Rotator cuff tears</th>
<th>diagnosis tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hawkins</td>
<td>&gt;40</td>
<td>39</td>
<td>84%*</td>
<td>arthrogram</td>
</tr>
<tr>
<td>Ribbans</td>
<td>&gt;50</td>
<td>16</td>
<td>63%</td>
<td>CT/arthrograph</td>
</tr>
<tr>
<td>Neviaser</td>
<td>&gt;40</td>
<td>21</td>
<td>86%*</td>
<td>18/21 arthroscopy</td>
</tr>
<tr>
<td>Toolanen</td>
<td>&gt;40</td>
<td>65</td>
<td>38%</td>
<td>ultrasonographic</td>
</tr>
<tr>
<td>Gumina</td>
<td>&gt;60</td>
<td>58</td>
<td>61%</td>
<td>imaging studies/clinically</td>
</tr>
<tr>
<td>Peny</td>
<td>&gt;40</td>
<td>52</td>
<td>35%</td>
<td>clinically MRI/arthrograph</td>
</tr>
<tr>
<td>Berbig</td>
<td>10-99</td>
<td>167</td>
<td>31.7%</td>
<td>ultrasonographic</td>
</tr>
<tr>
<td>Stayner</td>
<td>&gt;40</td>
<td>95</td>
<td>12%*</td>
<td>not all patients MRI/arthrograph</td>
</tr>
<tr>
<td>Robinson</td>
<td>47.5 (13-97)</td>
<td>538</td>
<td>13.4%</td>
<td>ultrasonographic</td>
</tr>
</tbody>
</table>

* = selected group
Neurological lesions
Brachial plexus injury may occur. The majority of these lesions are of the infra-clavicular type. Blom and Dahlbäck (1970) found 69% of nerve injuries following an anterior shoulder dislocation. They also found that these injuries were much more common in patients older than 50 years.

In the study of Pevney et al. (1998) 8% sustained axillary nerve palsy. All but one fully recovered. Toolanen et al. (1993) reported a rate of 65% of their patients who had an electromyogram confirmed nerve injury. In his study, Visser (1998) found a nerve injury in 48% of 77 anterior shoulder dislocations. The axillary nerve appeared to be the most frequently involved nerve. (42%). He concluded that age appeared to be a significant factor in determining the probability of nerve injury. The risk of nerve injuries increases with a factor of 1.2 every decade. The severity of the nerve injury also increases with age. Visser also found that if an associated fracture was present, the severity of nerve damage and the number of nerves involved were increased significantly.

Rotator cuff ruptures and nerve lesions
The first report of this combination was published by Ludin et al. (1975). Pasila et al. (1978) reported further 4 cases of this combined lesion that occurs after dislocation of the shoulder. This combination of nerve injury, rotator cuff tear and shoulder dislocation is called the “terrible triad of the shoulder”.

In the study of Pevney et al. (1998) all patients with a nerve injury had a rotator cuff rupture. Only 50% of the patients with a nerve injury were reported to have excellent or good results, compared with 82% of those without nerve damage. This may be due to the rotator cuff rupture, because most of the nerve injuries in their study were of a temporary nature. Neer (1990) advised to repair the rotator cuff without waiting for the axillary nerve to recover. Repairing the rotator cuff seems to have a beneficial effect before attempts are made to stabilise and restore the fulcrum as the deltoid then works against gravity.

Greater tuberosity fractures
Johnson and Bayley (1982) found in their series of the Royal National Orthopaedic Hospital in London a 24% incidence of fractures after anterior shoulder dislocations. This outcome was similar to Watson-Jones’ conclusion (1957), he found 30% fractures of the greater tuberosity. In most cases, the greater tuberculum fragment is repositioned in an acceptable position after reduction of the shoulder. However, in some cases the fragment is pulled back medially and posterior by the rotator cuff muscles.

McLaughlin (1963) has shown that any fragment of the greater tuberculum with more than 1 cm displacement leads to a poor functional end result. If recognised early, repair should not be too difficult and will give a good functional result.
Visser (1998) reported in his thesis about 14 of 77 patients with acute shoulder dislocations who sustained a fracture.27 Twelve of these 14 patients had a greater tuberosity fracture (12/77 = 16%). Two had a glenoid avulsion fracture (2/77 = 3%). The average age of these 14 patients was 69 years (32.5-88.6)

Te Slaa et al. (2003) found in their series of acute first-time anterior shoulder dislocations (n=107) an associated fracture in 20 patients (19%).25 There were 5 glenoid rim fractures (5%) and 15 fractures of the greater tuberosity (14%). The incidence of a fracture of the greater tuberosity (GT) was clearly influenced by age. There was a correlation between GT and age: the odds ratio for age (in years) on the probability of GT is 1.03 (95% c.i. [1.00-1.05]; p=0.04) implying that the probability of a fracture of GT increases by 3% for each year increase of the patient’s age at the time of dislocation.

The probability of recurrence is associated with the existence of a fracture (of any type): the odds ratio of fracture on recurrence is 0.12 (95% c.i. [0.02-0.92]; p=0.04) implying an 8 fold reduced probability of recurrence among those patients experiencing a fracture compared to those who had no fractures.

In the study of Robinson et al. (2002) they found an early redislocation rate of 3.2% within the first week after the initial dislocation.20 There were 17% greater tuberosity fractures (n=92) and 5% glenoid rim fractures (n=27). Patients with an increased risk of early redislocation included those who sustained the initial dislocation as a result of high-energy injury (relative risk =13.7), those who had a neurological deficit (relative risk=2.0), and those who sustained a large rotator cuff tear (relative risk=29.8). Also those who sustained a dislocation with an associated glenoid rim fracture (relative risk=7.0), and those who had a fracture of both the glenoid rim and the greater tuberosity (relative risk=33.5) have an increased risk of early redislocation. None of the 81 patients with an isolated greater tuberosity fracture had a redislocation within the first six weeks.

**Adhesive Capsulitis**

Adhesive Capsulitis can occur after a first-time shoulder dislocation and immobilisation. This diagnosis is discussed infrequently in the literature but can be a serious late complication in the elderly.24 Penvy et al. (1998) found a 10% incidence of adhesive capsulitis, 40% had a rotator cuff injury as well.17 Stayner et al. (2000) reported in his series an incidence of 6.3%. Four out of his six patients developed loss of motion resistant to conservative treatment.24
Conclusion
In conclusion we can say that according to the literature the incidence of rotator cuff ruptures after AFASD in patients older than 40 years ranges from 35% to 86%. Nerve injury after a shoulder dislocation varies between 48% and 69%. However, these are mostly of a temporary nature. Greater tuberosity fractures are more frequent in the elderly population. The incidence varies between 14-30% depending on age. If the patient has still pain and no active elevation 1-2 weeks following an acute first-time anterior shoulder dislocation, early diagnosis and subsequent surgical treatment should be started.
The acute first-time anterior shoulder dislocation in elderly patients

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