An epidemiological study of patterns of condylar fractures in children

H. Thorén, T. Iizuka, D. Hallikainen, M. Nurminen, C. Lindqvist

Department of Oral and Maxillofacial Surgery, Helsinki University Central Hospital; Department of Radiology, Helsinki University Central Hospital; Department of Public Health, University of Helsinki, Helsinki, Finland

SUMMARY
Objective - To find out how the site and type of condylar fracture are affected by its aetiology and the age and sex of the patient.

Design - Retrospective study.

Setting - Tertiary referral centre, Finland.

Material - Radiographs of 101 children (aged 15 years or less) with 119 condylar fractures.

Main outcome measures - Site of fracture and degree of displacement.

Results - A total of 26 of the 119 fractures were intracapsular (22%) and 93 (78%) extracapsular. Only among patients less than 6 years of age was there a preponderance of intracapsular fractures (7/12 fractures in 10 patients, 58%). In the older children 78% (83/107) were in the condylar neck. There were few subcondylar fractures (5/119, 4%). Only 6 fractures were displaced (5%). Dislocation of the condyle from the glenoid fossa was common in all age groups.

Conclusion - The site of condylar fracture is age related, but not associated with sex or aetiology.

INTRODUCTION

The mandible often fractures in the condylar region (19–38%),12 and in children the proportion is even higher than in adults (28–60%).3,4 Condylar fractures are therefore an essential part of paediatric facial traumatology. However, general knowledge about the pattern of condylar fractures and their distribution is still incomplete. It has been claimed that fractures of the condyle in young children are predominantly intracapsular and high neck fractures, and that low condylar fractures (fractures extending into the ramus) make up only a small portion.16 Bradley,17 on the other hand, reported that most condylar fractures in children are extracapsular (78%).

Epidemiological studies about facial fractures usually include both lower and middle-third fractures. Although most studies have dealt with the occurrence and treatment of mandibular fractures, detailed statistics about condylar fractures alone are scarce and most such studies have been concerned mainly with late clinical and radiological findings.18–21 The site and type of new fractures have rarely if ever been analysed.22–24

The aim of this study was to find out from a radiological analysis the incidence and characteristics of condylar fractures in children.

PATIENTS AND METHODS

A total of 138 patients under 16 years of age (range 1–15) with condylar fractures of the mandible were examined and treated at the Department of Oral and Maxillofacial Surgery, Helsinki University Central Hospital, Finland, from 1980 to 1991. Radiographs taken immediately after the accident were available for 101 patients (73%) with a total of 119 condylar fractures. These patients were included in the study.

Fifty-eight (57%) of the children were boys and 43 (43%) girls, giving an overall boy-girl ratio of 1:0.7 with a mean age of 10 years. About a third of the patients (n=32) were between the ages of 10 and 12 years. Only 10 of the children were 5 years or younger. The age groups 6–9 and 13–15 years were about the same size (n=30 and n=29, respectively). The sex distribution by age categories was not significantly different although there was a male preponderance in three of the four age groups (Table).

All available radiographs were analyzed by one radiologist (DH). The radiographs included panoramic images, Towne views, axial views, and lateral panoramic images of both joints. Panoramic images were available for all cases. No computed tomograms were available. The fractures were classified as intracapsular or extracapsular. The extracapsular ones were further classified as neck or subcondylar fractures. Subcondylar fractures were

Table - Site and MacLennan class of fractures according to age (119 fractures in 101 patients)

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>0-5</th>
<th>6-9</th>
<th>10-12</th>
<th>13-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>8</td>
<td>12</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Girls</td>
<td>2</td>
<td>18</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Site of fracture:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intracapsular</td>
<td>7</td>
<td>8</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Neck</td>
<td>5</td>
<td>25</td>
<td>28</td>
<td>30</td>
</tr>
<tr>
<td>Subcondylar</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>MacLennan class of extracapsular fractures:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>2</td>
<td>8</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>II</td>
<td>1</td>
<td>5</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>III</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>IV</td>
<td>2</td>
<td>13</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>
defined as a fracture running downwards and backwards from the sigmoid notch (Fig. 1). The degree of displacement of the extracapsular fractures was categorized according to MacLennan into four classes: I. Nondisplaced (Fig. 2); II. Deviation at the fracture line (Fig. 3); III. Displacement (overlap of the fracture fragment and the major mandibular fragment respectively but the condyle still in the glenoid fossa) (Fig. 4); and IV. Dislocation (the condyle dislocated from the glenoid fossa) (Fig. 5).

Medical records of the patients were reviewed and information collected on sex, age at the time of the injury, cause of the accident, associated fractures of the facial skeleton, and other injuries. The causes of injury were divided into six groups: motor vehicle accidents, bicycle accidents, falls, sports, violence, and hit by an object. The patients were further divided into four age groups according to the general development of the dentition: 0–5 years, 6–9 years, 10–12 years, and 13–15 years. The data were analysed focusing on whether the site and type of fracture was affected by the aetiology, sex and age of the patient. The independence of the site and type of fracture from age group and aetiology was first tested by the Kruskal-Wallis test for two-way contingency tables with exact two-tailed P-values using StatXact. The accident frequency data were further analysed by log linear Poisson models for four-way...
Fig. 3-(A, B)  MacLennan class II fracture.

Fig. 4-(A, B)  MacLennan class III fracture.
Patterns of condylar fractures in children

contingency tables using S-Plus. In the multivariate modelling, site and type of fracture were regarded as outcome variables, while aetiology, gender and age were considered to be explanatory variables. The initial model terms included all main effects and the interaction effects involving only explanatory variables. A step wise procedure was used to search for significant interactions between the outcome and explanatory variables, and to safeguard against possible bias.

RESULTS

Eighty-three patients (82%) had a unilateral and 18 (18%) a bilateral condylar fracture. Forty-seven (57%) of the unilateral fractures were of the right and 36 (43%) of the left condyle.

Radiological analyses of the fracture sites showed a marked predominance of condylar neck fractures (88/119, 74%) (Table).

The most common aetiological factor was a bicycle accident (49 of 101 patients, 48%) followed by motor vehicle accidents (18/101, 18%), sports-related accidents (15/101, 15%) and falls (13/101, 13%). Five children (5%) were involved in violence, and one (1%) was hit by an object. Twenty-nine patients (29%) had an associated fracture of the mandible, mainly (76%) in the symphyseal region. Six patients (6%) had a total of 9 fractures of the midface. Most of these were of the Le Fort type (n=3), situated in the zygoma (n=2) or in the alveolar process (n=2). A total of 14 patients (14%) received 18 other injuries in the rest of the body, generally cerebral contusion or commotio cerebri, or a fractured limb.

In a log linear analysis the site of the fracture depended significantly on the age of the patient (P=0.02) but not on the sex distribution. Among the 10 children younger than 6 years old, there were 7 intracapsular and 5 extracapsular fractures. The corresponding figures for the oldest age group (13–15 years) were 1 and 32, respectively. In the two other age groups, the incidence of intracapsular and extracapsular fractures was about the same (8 and 26, and 10 and 30, respectively). A neck fracture was most common in all age groups except the youngest (Table). Subcondylar fractures occurred only in the over 5-year-olds, and the incidence increased slightly with age.

In the log linear analysis we could not reject the null hypothesis that the fracture types were identically distributed according to age grouping. Nevertheless, the fracture types of MacLennan's classification III were observed exclusively in the two older age groups. Dislocation of the condyle from the fossa (MacLennan class IV) was common in all age groups (Table).

There was no relation between the aetiology and the site or type of condylar fracture.

Other fractures of the mandible were often associated with unilateral condylar fractures (n=19, 65%). Midfacial fractures, on the other hand, were mostly seen in the patients with bilateral condylar fractures (n=7, 78%).
DISCUSSION

Boys are more prone to maxillofacial fractures than girls,1-3 and bicycle accidents, motor vehicle accidents, and falls are the most common aetiologic factors.4,5,6 Our series, in which condylar fractures were analysed separately, showed the same characteristics with respect to both boy:girl ratio and cause of accident.

In previous studies of paediatric condylar fractures, subcondylar sites have been reported as being more common than condylar neck and head fractures.7,8 Gilhuus-Møe9 reported that 55% of the fractures in children less than 19 years old were subcondylar, 42% were situated in the neck and only 3% in the head. Lund10 found a high proportion (45%) of ‘low’ condylar fractures in children aged 4–17 years old. Fracture dislocation has also been commonly found, and the incidence varies from 57 to 68%.2,11,12 There is a discrepancy between our results and those previously reported; we found that most of the fractures were situated in the neck region, followed by intracapsularly situated. Only 4% of the fractures were subcondylar. The incidence of dislocated fractures (MacLennan class IV) was also lower in our study (39%).

One reason for the discrepancy in results may be that the fracture sites are not defined in the same way in all studies. Another reason may be that the age distribution is different. Our study showed that the site of fracture was related to the age of the patient. Based on conventional radiographs, it seems that there is a predominance of intracapsular fractures among younger children. In patients less than 5 years old, more than half the fractures were intracapsular. No subcondylar fractures occurred in this age group but became more common with increasing age. Intracapsular fractures were extremely rare in children aged 13 years or more. Gilhuus-Møe9 reported that the incidence of subcondylar fractures was highest in the oldest age group (12–18 years) (67%). Neck fractures, on the other hand, were most common in the two youngest age groups (1–5 and 6–11 years). The incidence of intracapsular fractures decreased with increasing age, and none of these were found in the oldest children. The older the children, therefore, the lower the incidence of intracapsular fractures. In children the relationship between the patient’s age and the fracture site should be taken into consideration. Unfortunately, no computed tomograms had been done. It is possible that certain vertical fractures can be diagnosed only by CT, but the number of such fractures is probably low.

The age-related distribution of fracture sites probably corresponds to the anatomical development of the condylar process. When an injury occurs in the condylar process of a young child, the thickness of the condylar neck and the flexibility of the mandible directs the traumatic force towards the condylar head. It will be pressed against the glenoid fossa and when the force is strong enough an intracapsular fracture will occur. As the mandible further matures, the condylar neck grows longer and becomes thinner and is, therefore, more prone to fracture.

The distribution of condylar fractures in children is totally different from that in adults. A survey similar to the present one in the same Helsinki population during almost the same study period showed that most adult patients (62%) had subcondylar fractures.7 The incidence of intracapsular fractures was the lowest (14%), and only 24% of the fractures were in the neck. The type of fracture was mainly influenced by the type of accident. Most (45%) of the fractures were in MacLennan’s class II and were caused by assault. Severe fractures with dislocation were the least common (16%), and these were mainly associated with high velocity accidents. In children there was no direct relationship between aetiology and type of fracture.

In conclusion, it seems that the fracture site is age-related, most likely influenced by the developmental anatomy of the condylar process. The differences in the age distribution of patients is a possible reason for the discrepancy between our results and those reported in previous studies.

References

Patterns of condylar fractures in children


The Authors

H. Thorén DDS
Research Associate
Department of Oral and Maxillofacial Surgery

T. Iizuka MD, DDS, PhD
Senior Oral and Maxillofacial Surgeon
Department of Oral and Maxillofacial Surgery

D. Hallikainen MD, PhD
Senior Radiologist
Department of Radiology

C. Lindqvist MD, DDS, PhD
Head Department of Oral and Maxillofacial Surgery
Helsinki University Central Hospital
Kasarmikatu 11-13,
00130 Helsinki Finland

M. Nurminen, DrPH, PhD
Senior Researcher
Department of Public Health FIN-00014
University of Helsinki
Helsinki, Finland

Correspondence and requests for offprints to Dr H. Thorén

Paper received 11 March 1996
Accepted 11 April 1997