

Table 2: of included studies : All fractures [Posted as supplied by author]

<p>Author(s): Hoskote AU, et al ^{w2}</p> <p>Title: Fractures in infants: one in four is non-accidental</p> <p>Year:2003</p> <p>Country: UK</p> <p>Study design: retrospective cross sectional</p> <p>Time period: 2 years, 1/1/93 – 31/12/94</p>	<p>Ascertainment; all children seen in emergency department with fracture, identified from liaison Health Visitor database</p> <p>Data source: review of notes</p> <p>Radiology: all 7 abused had skeletal survey, no detail of non-abused</p> <p>Outcome measure: age of child, fractures: site and number</p> <p>Ranking of abuse: (1): referral to social services and child protection outcome recorded</p> <p>Ranking non-abuse: (1): relied on history recorded at the time and no child protection concerns after five years follow up.</p> <p>Gender: 17 boys, 11 girls</p> <p>Age: 0-1yr</p>	<p>Fractures: 7/ 28 (25%) infants had fractures due to abuse. 4/7 had multiple #s,</p> <p>Age relationship Fractures in all of the 5 children under 4 months of age were due to abuse.</p> <p>Fracture site</p> <table border="1" data-bbox="1115 464 1632 695"> <thead> <tr> <th></th> <th>Abuse n=7</th> <th>Non abuse (n=21)</th> </tr> </thead> <tbody> <tr> <td>skull fracture</td> <td>3</td> <td>2</td> </tr> <tr> <td>femoral</td> <td>4</td> <td>4</td> </tr> <tr> <td>humeral</td> <td></td> <td>5</td> </tr> <tr> <td>Radial/ulnar</td> <td></td> <td>5</td> </tr> <tr> <td>Clavicle</td> <td></td> <td>3</td> </tr> <tr> <td>Finger</td> <td></td> <td>2</td> </tr> </tbody> </table>		Abuse n=7	Non abuse (n=21)	skull fracture	3	2	femoral	4	4	humeral		5	Radial/ulnar		5	Clavicle		3	Finger		2	<p>Study quality : small study, population limited to infants. Skeletal survey in abused but not in non-abused group. Good security of diagnosis of abuse. No independent radiology review</p> <p>Potential confounders. No mention of bone dysplasia/ fragility</p>
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<p>Author(s): Kowal-Vern A et al ^{w3}</p> <p>Title: Fractures in the under 3 yr old age cohort</p> <p>Year: 1992</p> <p>Country: USA</p> <p>Study design: retrospective cross-sectional</p> <p>Time period: 5 years, 1984-1989</p>	<p>Ascertainment: All children admitted to single large urban unit with fracture of any type</p> <p>Data source. Medical records radiographs and social service evaluation of all cases.</p> <p>Radiology. (Skeletal survey in 67% of all abused group) no detail non abused group</p> <p>Outcome measures: age of child, fractures, site, cause;</p> <p>Ranking of abuse (2): 95% children in overall study had social service assessment. All were confirmed cases of abuse.</p> <p>Ranking of non-abuse (1): abuse actively excluded and non-abusive traumatic cause confirmed.</p> <p>Gender: not stated for individual fracture type</p> <p>Age: 0-3 years</p>	<p>Fractures: 29/124 (23%) children with fractures were due to abuse. 95 non-abusive (27 MVA, 68 other “accidents”)</p> <p>Age relationship: In passenger MVC and abuse the mean age was significantly less than pedestrian MVC and other accidents p<0.05</p> <p>Fracture site</p> <table border="1" data-bbox="1115 967 1632 1139"> <thead> <tr> <th></th> <th>Abuse n=29</th> <th>Non abuse n=95</th> </tr> </thead> <tbody> <tr> <td>skull</td> <td>16 (55%)</td> <td>61 964%0</td> </tr> <tr> <td>femoral</td> <td>4 (14%)</td> <td>10 (10.5%)</td> </tr> <tr> <td>humeral</td> <td>5 (17%)</td> <td>5 (5.2%)</td> </tr> <tr> <td>rib</td> <td>4 (29%)</td> <td>2 (2%)</td> </tr> </tbody> </table>		Abuse n=29	Non abuse n=95	skull	16 (55%)	61 964%0	femoral	4 (14%)	10 (10.5%)	humeral	5 (17%)	5 (5.2%)	rib	4 (29%)	2 (2%)	<p>Study quality: A small retrospective study of traumatic fractures. Good security of diagnosis. No independent radiology review. Skeletal survey in most of abused group, not stated for non-abused group</p> <p>Possible bias: towards more serious admitted cases. (<i>Authors estimated one child (< 3 years) a month with a fracture were seen in A +E and sent home</i>). Study limited to children under three. Comparison group limited to non -abusive trauma. Number of fractures increased year on year which may reflect changing referral criteria during the study.</p> <p>Potential confounders. No mention of bone dysplasia/ fragility.</p>						
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<p>Author(s): Leventhal JM, et al ^{w4}</p> <p>Title: Fractures in young children. Distinguishing child abuse from unintentional injuries</p>	<p>Ascertainment: 201 consecutive children with fractures at a single hospital, identified from A/E records and child abuse registry. Study extended to include 14 abuse cases from 1984. Fractures due to bone fragility were</p>	<p>Fractures: 45/201 (22.4%) children had fractures due to abuse (consecutive cases)</p> <p>Age relationship 36/96 (37.5%) of children under one year had fractures due to abuse vs. 9/105 (8.6%)</p>	<p>Study quality: large study of trauma induced fractures. Cases of unknown cause isolated from analysis. Good security of diagnosis of abuse due to four independent review of likelihood of abuse.</p>																					

<p>Year: 1993</p> <p>Country: USA</p> <p>Study design: retrospective cross sectional</p> <p>Time period: five years 1979-1983</p>	<p>excluded.</p> <p>Data source: medical records and radiology</p> <p>Radiology: 38% , 81/201 children had skeletal survey</p> <p>Outcome: fractures, site ,number</p> <p>Ranking of abuse: (3) consensus from four independent investigators to judge certainty of abuse using features independent of those being studied against a 7 level scale of certainty.</p> <p>Ranking non abuse: (2) as above using stated criteria for non-abuse.</p> <p>Gender: 122 male, 93 female</p> <p>Age: range 0-36 months, mean 15.7 months. (0-1 yr = 103, 1-2 yrs=51, 2-3 yrs=61)</p>	<p>1-3 year olds</p> <p>Number of fractures</p> <p>Abuse: 52 children had 84 fractures</p> <p>Unknown: 18 children had 18 fractures</p> <p>Non-abuse: 145 children had 151 fractures</p> <p>Fracture site (per no. fractures)</p> <table border="1" data-bbox="1115 408 1635 611"> <thead> <tr> <th></th> <th>Abuse n=84</th> <th>Non-abuse n=151</th> </tr> </thead> <tbody> <tr> <td>skull</td> <td>31 (37%)</td> <td>62 (41%)</td> </tr> <tr> <td>femoral</td> <td>9 (11%)</td> <td>13 (8.6%)</td> </tr> <tr> <td>Humeral</td> <td>13 (15%)</td> <td>3 (2%)</td> </tr> <tr> <td>Ribs</td> <td>12 (14%)</td> <td>0</td> </tr> </tbody> </table> <p>Skull fractures</p> <p>104 fractures in 94 children</p> <p>Parietal fracture commonest site in abuse and non-abuse (25/31 (85%) vs. non-abuse 48/62 (77%) p=n.s.)</p> <p>linear fracture commonest fracture type</p> <p>Abuse 14/31 (54%) Non-abuse 42/62 (74%)</p> <p>p=n.s</p> <p>No significant difference in linear, multiple, depressed, diastatic or depressed fractures between both groups.</p>		Abuse n=84	Non-abuse n=151	skull	31 (37%)	62 (41%)	femoral	9 (11%)	13 (8.6%)	Humeral	13 (15%)	3 (2%)	Ribs	12 (14%)	0	<p>Radiograph review included</p> <p>Possible bias: towards abused children due to the addition of 14 known cases of abuse to cross sectional sample. However prevalence figures were given for the children who were enrolled consecutively.</p> <p>The enhanced data is useful to address compare fracture types and sites.</p> <p>Possible bias: to under recognition of fractures in 62% who did not have skeletal surveys.</p> <p>NB. Study gives comparative data per number of fractures. Detail of long bone fractures for same case series is given in study by Thomas et al ^{w17}</p>
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<p>Author(s): McClelland CA et al ^{w5}</p> <p>Title: Fractures in the first year of life: a diagnostic dilemma</p> <p>Year: 1982</p> <p>Country: USA</p> <p>Study design: retrospective cross sectional</p> <p>Time period: 3 year period</p>	<p>Ascertainment: all infants admitted with fracture to single hospital</p> <p>Data source: medical records</p> <p>Radiology: not stated</p> <p>Outcome measures: site, character of fracture cause</p> <p>Ranking of abuse: (1): using stated criteria of history, presentation and review by multidisciplinary child abuse team, all subject of ongoing child protection.</p> <p>Ranking non-abuse: (4): cause not stated in all cases</p> <p>Gender: 17 boys, 17 girls</p> <p>Age: under 1 year old,</p>	<p>Fractures: 34 children had 55 fractures</p> <p>19/34 (56%) children were abused</p> <p>15 children were non-abused, 8/15 had constitutional abnormalities that predispose to fractures (1 OI, 2 osteopenia, 2 Downs, 1 cerebral palsy, 2 chronic pulmonary disease).</p> <p>Number of fractures.</p> <p>1.6 per child, no difference between abused and non abused group.</p> <p>Fracture site</p> <table border="1" data-bbox="1115 1198 1635 1315"> <thead> <tr> <th></th> <th>Abuse n=19</th> <th>Non-abuse n=15</th> </tr> </thead> <tbody> <tr> <td>skull</td> <td>13 (68%)</td> <td>8 (53%)</td> </tr> <tr> <td>extremities</td> <td>12 (63%)</td> <td>7 (46%)</td> </tr> </tbody> </table> <p>Age relationship</p>		Abuse n=19	Non-abuse n=15	skull	13 (68%)	8 (53%)	extremities	12 (63%)	7 (46%)	<p>Study quality: Small study of selected age group. Good security of diagnosis for abuse, no mention of how abuse excluded in non-abuse group. No radiology detail. Bone fragility considered.</p> <p>Possible bias: under recognition of fracture due to non- admission (authors estimate 5% cases may not be admitted in this age group)</p> <p>Bias: towards children with host abnormality increasing fracture risk (53% of non-abuse cases)</p>						
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<p>Author(s): Rosenberg N et al ^{w6}</p> <p>Title: Fractures in infants: a sign of child abuse</p> <p>Year: 1982</p> <p>Country: Michigan, USA</p> <p>Study design: retrospective, cross sectional</p> <p>Time period: (1 year) 1978</p>	<p>Ascertainment: All infants with fracture seen in single emergency department</p> <p>Data source: Medical records</p> <p>Radiology: not stated</p> <p>Outcome measures: fracture site, type and cause.</p> <p>Ranking of abuse: (3): suspected abuse based on: no, variable or incompatible history of trauma, delay in seeking advice or associated findings</p> <p>Rank non-abuse: (2): confirmed cause and absence of the above.</p> <p>Gender: not stated</p> <p>Age : under one year</p>	<p>Fractures: 22/49 (45%) children with fractures were from abuse. 27 were non-abused, 21 falls (most fell whilst held by carer), 6 (birth injury, blunt trauma or metabolic bone disease)</p> <p>Fracture site</p> <table border="1"> <thead> <tr> <th></th> <th>Abuse n=22</th> <th>Non-abuse n=27</th> </tr> </thead> <tbody> <tr> <td>skull</td> <td>10 (45%)</td> <td>12 (44%)</td> </tr> <tr> <td>femoral</td> <td>5 (23%)</td> <td>3 (11%)</td> </tr> <tr> <td>humeral</td> <td>4 (18%)</td> <td>2 (7%)</td> </tr> <tr> <td>Radius/ulnar</td> <td>3 (14%)</td> <td>5 (18.5%)</td> </tr> </tbody> </table>		Abuse n=22	Non-abuse n=27	skull	10 (45%)	12 (44%)	femoral	5 (23%)	3 (11%)	humeral	4 (18%)	2 (7%)	Radius/ulnar	3 (14%)	5 (18.5%)	<p>Study quality: A small retrospective study of limited age group of fractures of all causes. No detail of radiology or independent radiology review.</p> <p>Possible bias: Limited to under ones</p>
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<p>Authors: Skellern CY, et al. ^{w7}</p> <p>Title: Non-accidental fractures in infants: risk of further abuse</p> <p>Year: 2000</p> <p>Country: Australia</p> <p>Study design: Retrospective cross-sectional</p> <p>Time period: 4 years 01/1990-12/1993</p>	<p>Ascertainment: All infants attending a single large children's hospital with a fracture, identified from injury surveillance project. Excluding children with shaken baby syndrome.</p> <p>Data source: review of medical records, child protection register and records.</p> <p>Radiology: 25% had skeletal survey</p> <p>Ranking of abuse: (2) child protection medical staff decision, according to stated criteria and referral to SCAN team.</p> <p>Ranking of non-abuse: (2), injury consistent with stated cause and no child protection concerns by medical staff.</p> <p>Gender: 64 boys, 35 girls</p> <p>Age: 0-12 months</p>	<p>Fractures: 26/99 (26%) infants with fractures were due to suspected abuse. (15 confirmed/ 7 abuse excluded/ 4 indeterminate)</p> <p>73/99 (74%) non abusive</p> <p>Age relationship 50% of suspected abuse cases were < 4 months vs 16% accidental, p=.0007</p> <p>Fracture site/type No differences in gender, site or type of fracture. Skull and femur #s most prevalent in both groups.</p>	<p>Study quality : study of limited age group. Criteria identify suspected cases of abuse which are quoted throughout yet in 11 of the 26 cases abuse was excluded or not determined by child protection services. Limited data on fracture site and type presented.</p> <p>Possible bias. Authors state that abusive cases may have been underestimated. As children with shaken baby syndrome were excluded and children identified from injury surveillance system which requires patient consent and therefore may underestimate abused cases. Only 25% had skeletal survey, thus fractures may be underestimated in 75%.</p> <p>Potential confounder: no consideration of conditions leading to bone fragility</p>															
<p>Author(s): Worlock P et al ^{w1}</p> <p>Title: Patterns of fractures in</p>	<p>Ascertainment: All children with fractures from confirmed abuse identified from NSPCC child abuse records 1976-1982.</p>	<p>Fractures: 35 children with fractures due to abuse 116 children with non-abuse.</p>	<p>Study quality: high security of diagnosis. No detail of radiology given. Interpretation limited by counting number of fractures</p>															

<p>accidental & non-accidental injury in children: a comparative study</p> <p>Year: 1986</p> <p>Country: UK</p> <p>Study design: retrospective case control</p> <p>Time period: 1976-1982</p>	<p>Control group were children with fractures attending single emergency unit for the same catchment Jan-June 1981 (abuse excluded). Cases identified from emergency and radiology records.</p> <p>Data source: case records</p> <p>Outcome: fracture, type and site</p> <p>Ranking of abuse (1): confirmed abuse registrations on child protection</p> <p>Exclusion of abuse (1): abuse excluded</p> <p>Gender: 35 abused, 24 boys, 11 girls. 116 controls, 59 boys, 57 girls</p> <p>Age: comparison given for 0-5 year olds</p>	<p>Age relationship No child older than 5yrs had a fracture due to abuse. 80% of abusive fractures occurred in children <18/12, 85% of accidental #s occurred over 5 yrs.</p> <p>Number of fractures Abused: 9 had 1 #, 7 had 2, 19 had 3/> Non-abuse 97 had 1 #, 19 had 2 #'s. Abused children had significantly more fractures than non abuse (p<.001). <i>(It is difficult to tell the extent to which multiple rib fractures influence this calculation)</i></p> <p>Metaphyseal chip fractures: 17 amongst 35 abused vs. none amongst 116 non-abuse</p> <p>Spiral # of humerus in 9/35 abused children vs. none in child <5yrs after "accidental" injury ($\chi^2 = 27.0$ p<.0001.)</p> <p>Skull fractures 12 abused children had 16 skull fractures vs. 18 non-abused children who had 23 skull #s, <i>(text and table differ)</i> Abuse 14/16 linear: Non-abuse 18/18 linear</p>	<p>rather than children with fractures. Study focuses on traumatic causes of fractures</p> <p>Possible confounders : no mention of pathological fracture</p>
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