

Long bone fractures in children under 3 years of age: Is abuse being missed in Emergency Department presentations?

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Objective: Distinguishing injuries due to accidents from those due to child abuse in young children is important to prevent further abuse. We aimed to study the presenting features, mechanism of injury, type of fracture and indicators of possible abuse in children under 3 years of age, presenting to the Emergency Department (ED) of a tertiary referral Children's Hospital, to see whether those injuries that were more likely abusive were distinguished from those that were more likely accidental.

Methods: We analysed the medical records from the Emergency Department Information System of all children below 3 years of age, who were treated for a long bone fracture at the Sydney Children's Hospital, Randwick, NSW, over a 1-year period. Demographic details, presenting complaint, mechanism of injury, type of fracture, other historical and examination data and action taken were noted. Nine indicators that raise suspicion of abuse were developed from the literature. Using these indicators, patients' ED notes were reviewed to establish whether long bone fractures suspicious for abuse had been referred for further evaluation.

Results: One hundred patients with a total of 103 fractures presented during the study period. No child had multiple fractures at a single visit. The fractures included 36 radius/ulna, 27 tibia/fibula, 20 humeral, 17 clavicular and three femoral. The mean age of patients was 21.6 months (range 13 days – 35 months). Fourteen patients were younger than 12 months. Review of the notes revealed 31 children with indicators suspicious for abuse, of whom 17 children had one indicator, 11 children had two indicators, and three children had three indicators. Only one child was referred for further evaluation to child protection.

Conclusion: Abuse cannot usually be determined by fracture type alone. Doctors in the ED miss indicators for abuse because they do not look for these indicators in the history and examination. Knowledge of indicators that raise suspicion of abuse is needed for a further forensic assessment to occur. The development of specific referral guidelines, ongoing education and a comprehensive injury form may improve referral of children from the ED to child protection.

Key words: children under 3 years of age; indicators raising suspicion of abuse; long bone fractures.

Fractures of the extremities are the most common skeletal injuries occurring in abused children and the incidence of abusive fractures is highest in infants and young children.^{1–10} Eighty percent of the fractures due to child abuse occur in children under 18 months of age.¹ The reported frequency of fractures associated with child abuse varies from 11 to 55%.² Distinguishing accidental from abusive fractures in young children is vital, as failure to recognize abuse may lead to further abusive injuries and even death.^{2–4,8} An explanation that is inconsistent with the injury always raises the suspicion of abuse. However, the distinction between an abusive long bone fracture and an accidental one cannot be made on the appearance of the fracture alone.^{1–4,6–9,11} Knowledge of the epidemiology and biomechanics of bone injury, child development and other risk factors for abuse, such as associated unexplained injury, may help heighten suspicion for abuse and lead to referral for further assessment.^{2,3,6,9} We aimed to study the presenting features, mechanism of injury and type of fracture in children under 3 years of age presenting to the Emergency Department (ED) of a Children's Teaching Hospital over a 1-year period. Specific emphasis was placed on whether indicators suspicious for abuse were identified and documented before a diagnosis of accidental injury was made. We hypothesized that if these indicators were not documented the diagnosis of abuse was unlikely to be considered.

METHODS

We obtained the medical records from the Emergency Department Information System (EDIS) of all children under 3 years of age who were treated for a long bone fracture at the ED of the Sydney Children's Hospital, Randwick, NSW, over a 1-year period from 1 January to 31 December 2000. The EDIS database, a computerized database of all admissions to the ED, was cross-referenced with the Child Protection Unit database to ensure that all referrals from the ED to child protection were included. Children were excluded from the study if the fracture was thought to be due to a congenital disorder or illness (e.g. metabolic bone disease) that weakened the bone. The EDIS database was analysed by a general paediatrician and a child protection specialist. We analysed demographic data, presenting complaint, mechanism of injury, other historical and examination data, and type of long bone fracture. Fracture pattern was recorded by bone and by site (epiphysis, metaphysis, diaphysis) and all patients' X-rays were reviewed by JT/KM. Referral and discharge patterns were also noted.

Nine indicators that have been cited as helpful in distinguishing potential abusive from accidental injuries were identified by reviewing the literature^{3,5–16} (Table 1). We reviewed the ED notes to see whether these indicators were documented by the emergency staff. The overall frequency of

Table 1 Indicators that increase suspicion of abuse^{3,5-16}

No.	Indicator
1	Incompatible or inconsistent history
2	All children under 1 year of age with a fracture
3	All patients with other injuries suspicious of abuse and a long bone fracture
4	High-risk fractures (non-supracondylar fracture of the humerus under 18 months, femur fractures in children under 1 year of age, old or healing fractures)
5	Previous presentation to the ED with a long bone fracture
6	Unreasonable or unexplained delay in presentation
7	All unwitnessed injuries
8	All patients who presented to the ED with more than one injury during the study period
9	All patients with more than one fracture during the study period

ED, Emergency Department.

each indicator documented was noted and the effect on subsequent referral patterns analysed.

RESULTS

The data consisted of 103 cases of long bone fracture. During the 1-year period there was a total of 102 patients under 3 years of age who presented to the ED with long bone fractures. Two patients were excluded due to osteogenesis imperfecta. The final sample consisted of 100 patients with a total of 103 fractures, as three patients presented twice during the year with separate fractures. None of the patients was diagnosed as having multiple fractures at a single presentation.

The mean age of the patients was 21.6 months (range 13 days – 35 months). Fourteen percent of patients were younger than 12 months, 35% were between 23 and 35 months, and 51% were between 24 and 35 months. Fifty-three percent were boys and 47% were girls.

Twelve children with fractures were admitted to hospital. The remainder were discharged and followed up at an out-patient fracture clinic. Only one child was referred to the Child Protection Unit for further evaluation. This was the only child who underwent a skeletal survey.

Of the 103 fractures, 36 were of the radius/ulna, 27 were tibia/fibula, 20 were humeral, 17 were clavicular and three were femoral (Fig. 1). Forty-seven percent of fractures were distal shaft, 35% were midshaft fractures and 17.5% were proximal shaft. Of the 20 humeral fractures, five (25%) were non-supracondylar. There were no classic metaphyseal fractures and no epiphyseal separation injuries. Figure 1 lists the fractures by site.

Table 2 reviews the presenting complaint for each fracture, as recorded by the ED staff. This was difficult to interpret as most ED physicians limited their documentation to a single presenting complaint. Apart from clavicular fractures, no

mention was made of a lump or swelling on examination. All humeral fractures and 75% of radius/ulna fractures resulted in children presenting with pain or not using a limb, while in the lower limb all femoral fractures, and over half of tibia/fibula fractures, presented with inability to bear weight. In some fractures (radius/ulna and tibia/fibula) up to 15% of children had their presenting complaint listed as crying with no initial suspicion of a fracture. The most common reported mechanism of injury in all fractures was a fall (79.6%; Table 3). Of the 82 children who fell, 55 (53.4%) fell from a height and 27 (26.2%) fell while running or playing. We were unable to categorize the height of the fall or the surface the child fell onto as this information was only included in seven children’s notes. Ten injuries were unwitnessed and three of the unwitnessed injuries occurred in children less than 12 months of age. The mechanism of injury in two patients was not stated.

We analysed the patient’s notes to see whether any of the indicators suspicious for abuse (Table 1) were documented. It is possible that there was an even greater number of children with indicators suspicious for abuse as a lack of documentation in the chart made it difficult to be certain that a particular indicator was looked for and not found (e.g. whether the child had an unclothed examination or only the symptomatic limb was examined, whether a developmental history was taken but not recorded) as opposed to not being looked for at all. Tables 4 and 5 illustrate our findings. A total of 31 children had indicators suspicious for abuse, of whom 17 children had one indicator, 11 children had two indicators and three children had three indicators. Only one of these 31 children was referred for further assessment to our Child Protection Unit. The child referred was an 18-month-old girl with an unwitnessed right midshaft fibular fracture and an unexplained delay in presentation. This child was subsequently diagnosed as having been abused on the basis of an inconsistent history and an incompatible mechanism of injury.

DISCUSSION

In 1946 Caffey described six children with subdural haematomas and clinically unsuspected fractures of the long bones with no history of injury.¹⁷ He suggested these injuries might be inflicted. A number of studies since then have examined the patterns and distribution of long bone fractures in large groups of abused children.^{1,3,6,9,10,18} Most of these found that long bone fractures, which have low specificity for abuse, are the most common injury in abused children. Classic metaphyseal lesions have a high specificity for abuse but may not occur as commonly as long bone fractures, except in cases of fatal abuse.^{2,18}

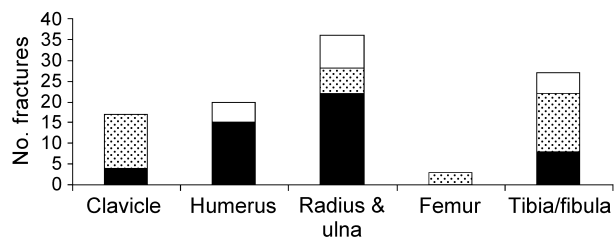


Fig. 1 Bone fracture by site. (□), Proximal; (◻), shaft; (■), distal.

Table 2 Presenting complaint, as recorded by ED physician

Bone	n	Lump/swelling		Pain		Not using limb		Not weight bearing		Crying	
		n	%	n	%	n	%	n	%	n	%
Clavicle	17	9	52.9	5	29.4	3	17.6	–	–	–	–
Humerus	20	–	–	8	40	12	60	–	–	–	–
Radius/ulna	36	–	–	9	25	18	50	3	8.3	6	16.6
Femur	3	–	–	–	–	3	100	3	100	–	–
Tibia/fibula	27	–	–	–	–	9	33	14	51.8	4	14.8
Total	103	9		22		45		20		10	

ED, Emergency Department.

Table 3 Mechanism of injury for the 103 fractures recorded in this study

Mechanism of injury	n	%
Fall from a height	55	53.4
Fall while running or playing	27	26.2
Unwitnessed	10	9.7
Unknown	2	1.9
Other (twist, blunt trauma, MVA)	9	8.7
Total	103	100

MVA, motor vehicle accident.

Table 4 Analysis of indicators that increase suspicion of abuse in the 103 fractures recorded in this study

No. indicators	n	%
1	17	16.5
2	11	10.6
3	3	2.9
Total	31	30
Cases referred to CPU	1	0.9

CPU, Child Protection Unit.

Abusive long bone fractures are almost always limited to children under 3 years of age.^{1–11} Eighty percent of abusive fractures are found in children under 18 months, whereas only 2% of accidental fractures are found in this group.¹ In the 14 children we identified with two or more abuse indicators (Table 4), eight out of 14 (57%) were under 1 year of age and 11 of the 14 (78.5%) were under 18 months of age. Leventhal *et al.* identified 215 children under 3 years of age with long bone fractures, 24% of whom were abused.³ Of the children under 1 year, 39% had been abused while only 8% of the over 2 years age group had evidence of abuse. Loder and Bookout similarly identified 75 children with abusive long bone fractures, of which 80% occurred in children under 2 years of age.⁶

While 10% of the children presented with crying without parental suspicion of a fracture, 80% of these children were under 1 year of age. Other common presenting complaints included pain (16.5%), not using a limb (40%) and not weight bearing (19.4%). A recent study on long bone fractures in children under 3 years found similar presentations, with pain (36%) being the commonest symptom followed by not using a limb (23%).¹² The nature of the presenting complaint, particularly in children under one, emphasizes the need for a thorough history and good physical examination with low threshold for X-ray to evaluate for possible fracture. Failure to do so may result in missed fractures and inappropriate treatment. There were no patients who presented with other injuries suspicious for abuse and a long bone fracture.

The commonest mechanism of injury in our study was a fall (79%). Falls from a height were twice as common as falls while running or playing (53% vs 26%). This frequency contrasts with other studies where falls accounted for 47 to 60% of fractures.^{3,8,12} Falls account for most accidental injuries in the USA.¹⁶ A fall is also the most common event offered as an explanation for significant inflicted bony injury.^{7,8,10,16} Helfer *et al.* found that of 246 children younger than 5 years with falls from sofas, beds or a distance less than 90 cm, only seven (3%)

suffered a fracture.¹⁹ Nimityongskul and Anderson²⁰ and Lyons and Oates²¹ state that a long bone fracture due to a fall from a bed or a cot in children who are not cruising is an unusual occurrence and that when offered as an explanation, an alternative should be sought. Falls from greater heights, from the arms of caretakers and falls downstairs may cause long bone fractures.¹⁶ Falls in children who are walking can result in long bone fractures.^{9,13–15} In our study, six children who were not cruising were reported to have sustained their injuries by falling from a cot or bed. No further explanation for their long bone fracture was sought by the ED staff and we feel that there should have been a forensic assessment in these cases.

Another case of concern was that of a 1-year-old boy who presented on four occasions during the study period. His first presentation was that of an unwitnessed fall at home and fracture of the proximal humerus was noted on X-ray. This is an unusual injury in this age group and is often associated with abuse. He was discharged for follow up at the Fracture Clinic. Two months later he returned, having 'tripped on a blanket'. An X-ray revealed a fractured radius. Again, he was discharged to the Fracture Clinic for follow up. Two months later he presented with a laceration of his left arm following a fall from his bike and was discharged with no follow up. Four months later he was brought in unconscious, having had an unwitnessed fall from a 4-m-high window. Fortunately, a computed tomography scan of his head was normal. He was discharged home with a Head Injury form. At no time was a full developmental and social history taken. Certainly no thought was given to indicators that might suggest abuse and no further assessment was undertaken.

The most frequently fractured long bone in abused children varies from study to study. In three studies it was the humerus,^{11,22,23} in two studies the femur^{5,24} and in one study the tibia.⁶ In all of the above studies the radius/ulna was the least-frequently fractured bone. In our study of children presenting to the ED, the radius/ulna was the most commonly

Table 5 Frequency of indicators that increase suspicion of abuse

Indicator	<i>n</i>
Incompatible or inconsistent history	6
All children under 1 year of age with a fracture	14
All patients with other suspicious injuries of abuse and a long bone fracture	–
High-risk fracture	
Non-supracondylar humerus fracture under 18 months	5
Femur fracture in children under 1 year	–
Previous presentation to ED with a long bone fracture	3
Unreasonable or unexplained delay in presentation	3
All unwitnessed injuries	10
All patients who presented to ED with more than one injury during the study period	4
All patients with more than one fracture during the study period	3
Total	48

ED, Emergency Department.

fractured bone (35.5%) and the femur was the least-frequently fractured bone (2.9%). An unpublished series of a similar group has also found the radius/ulna to be the most common long bone fracture in children under 3 years.¹²

Several studies have compared fracture types in young children in an effort to distinguish abusive from accidental injuries.^{1,3,5,6,9,11} Worlock *et al.*,¹ Leventhal *et al.*³ and Thomas *et al.*⁹ all found that humeral fractures, other than supracondylar fractures, were likely to be due to abuse, particularly in children under 1 year. They also concurred that supracondylar fractures are typically the result of accidents. However, in a study by Strait *et al.*, supracondylar fractures in children under 18 months had a high rate of being caused by abuse.⁵ In our study, 25% of humeral fractures were non-supracondylar and 80% of these fractures were in children under 1 year. There were two supracondylar fractures in children under 18 months. Of the four children in our study under 1 year with non-supracondylar fractures of the humerus, three were unwitnessed injuries and the fourth child was a 10-month-old boy reported to have fallen off a bed. None of these children had further assessments.

A femoral fracture in a non-walking child is highly associated with abuse. There have been four large studies concerning femoral fractures in young children.^{13–15,25} Dalton *et al.* state that all femoral fractures in children under 3 years should evoke suspicion of abuse.¹³ However, Schwend *et al.* believe that abuse is very unlikely in femoral fractures in ambulant children, unless there is other evidence of abuse.²⁵ They found a 42% risk of abuse in non-walking children, but only a 2.6% risk in walking children. Support for this argument is lent by Leventhal *et al.*³ who found 60% of infant femoral fractures were due to abuse, but no children over 2 years of age with femoral fractures were classified as abused. The consensus from all the above authors is that abuse is much more likely in non-walking children. All our femoral fractures were in ambulant children older than 18 months of age and all were thought to be accidental.

The classic metaphyseal lesion, which is a fracture through the metaphysis close to the physis and is seen on X-ray as a ‘corner’ or ‘bucket-handle’ fracture,⁶ is virtually diagnostic of child abuse.^{18,26} However, unless specifically looked for these will be missed.¹⁸ There is debate as to how frequently these fractures occur. Some authors believe that metaphyseal lesions are very common in abuse.^{6,21,26,27} Kleinman *et al.* found 89% of long bone fractures in 31 infant fatalities to be classic metaphyseal.²⁶ King *et al.*¹¹ and Worlock *et al.*¹ found diaphyseal lesions to be more common than metaphyseal

lesions in abused children. In a study of 35 children, Worlock found only 11% of abusive fractures to be metaphyseal. Possible reasons for the difference relate to the different study populations. Kleinman’s observations were in younger children who died from abuse. We found no classic metaphyseal lesions and although there are reports that cartilaginous epiphyseal plate injuries are common in abused infants,^{10,26} we found no epiphyseal separation injuries.

On review of the medical records using the nine indicators for suspicion of abuse (Table 1), we found a total of 31 children who had one or more indicators that merited further analysis before a diagnosis of accident could be assigned. This high number is in agreement with a recent study from Wales where in a study group of 97 children, they found 32% of children with one risk factor for abuse, 11% of children with two risk factors and 2% of children with three risk factors.¹² In the Welsh study 12.4% of children were referred for further assessment whereas in our study the referral rate was only 0.9%. This poor referral rate, despite identifying risk indicators, suggests that ED and orthopaedic staff are unaware of the significance of these indicators.

When taking a history from a caregiver of a young child in the ED, emphasis should be placed on demographic, developmental and other factors, as well as features of the fracture itself, in order to distinguish accident from abuse.^{1,2,6,7,11} An inconsistent mechanism of injury, an injury that is incompatible with a child’s development, an unreasonable or unexplained delay in presentation or a history of unwitnessed injury should alert nursing and medical staff to the possibility of an abusive injury. Of particular concern is any long bone fracture in a non-ambulant child. These flags should not be ignored. Further detailed history taking, review of developmental milestones and discussion with senior ED staff and/or the Child Protection Unit should be initiated when they are present.

Referral to a specialist team for further medical and psychosocial assessment plays a vital role in the multidisciplinary approach in the management of potentially abused children. Such a team was consulted only once during the entire study period despite there being ready access to such a service. The reasons for the poor referral rate remain unclear. Possible explanations are an unfamiliarity with the indicators of potential abuse in young children, difficulty in being sure about the mechanism of injury in a particular case or a concern on the part of the doctor that obtaining more details about the injury may lead to delay in seeing other patients in a busy ED. There may also be a reluctance to jeopardize the rapport with the family, the perception that one should be certain of the

diagnosis of abuse before referring the patient, and anxiety about potential legal consequences.^{28,29}

This audit, like previous studies,²⁹⁻³¹ also highlights that documentation of childhood injuries in the ED is inadequate, making any assessment for abuse difficult. Hospital notes that include entries such as 'Fracture radius and ulna - refer Fracture Clinic' are unacceptable and do not do anyone justice, particularly the patient. Even though many of the fractures may seem trivial, it is important that the ED doctors screen for children at risk for abuse by asking the correct questions, and do not simply treat the fracture in isolation. It is well recognized that child abuse may present in the form of a single acute long bone fracture,^{1,2,4,6,9,11} and emergency staff may miss these children if they are not educated and directed to consider other factors that will help make the diagnosis.

CONCLUSION

Doctors in the ED miss clues for abuse because they do not look for them in the history and examination. They also document their findings poorly. As a result, many children that require further assessment for abuse do not get referred. Potentially, these children may go on to further abuse. The need for a more formalized approach to young children with fractures in the ED has been highlighted.

In order to address the problem we have instituted a series of education sessions for Emergency staff, a new Injury Assessment form for young children that includes the nine indicators noted above, and the development of specific referral guidelines. All children under 1 year who have a fracture will be automatically reviewed by the Child Protection Team. A year after the introduction of these new measures, we aim to re-audit a similar group of ED presentations. We hope that better education and awareness of the potential indicators of child abuse will translate into better recognition and appropriate referral.

ACKNOWLEDGEMENTS

Dr Karen Zwi and Dr Dimitra Tzioumi for reviewing the manuscript and Linda Christie for assistance with the EDIS database.

REFERENCES

- 1 Worlock P, Stower M, Barbor P. Patterns of fractures in accidental and non-accidental injury in children. A comparative study. *BMJ* 1986; **293**: 100-2.
- 2 Kleinman PK. Skeletal trauma, general considerations. In: Corra E (ed.) *Diagnostic Imaging of Child Abuse*, 2nd edn. St Louis: Mosby, 1998; 8-25.
- 3 Leventhal JM, Thomas SA, Rosenfield NS, Mavkowitz RI. Fractures in young children. Distinguishing child abuse from unintentional injuries. *AJDC* 1993; **147**: 87-92.
- 4 Herndon WA. Child abuse in a military population. *J. Pediatr. Orthop.* 1983; **3**: 73-6.
- 5 Strait RT, Siegel RM, Shapiro RA. Humeral fractures without obvious etiologies in children less than 3 years of age: When is it abuse? *Pediatrics* 1995; **96**: 667-71.
- 6 Loder RT, Bookout C. Fracture patterns in battered children. *J. Orthop. Trauma* 1991; **5**: 428-33.
- 7 Kolwal-Vern A, Paxton TP, Ross SP, Lietz H, Fitzgerald M, Gamelli RL. Fractures in the under 3-year old age cohort. *Clin. Pediatr.* 1992; **31**: 653-9.
- 8 Rivara F, Kamitsuka M, Quan L. Injuries to children younger than 1 year of age. *Pediatrics* 1998; **81**: 93-7.
- 9 Thomas SA, Rosenfield NS, Leventhal JM, Mavkowitz RI. Lone bone fractures in young children. Distinguishing accidental injuries from child abuse. *Pediatrics* 1991; **88**: 471-6.
- 10 McClland CQ, Heiple KG. Fractures in the first year of life. *AJDC* 1982; **136**: 26-9.
- 11 King J, Diefendorf D, Aphthorp J, Negrete VF, Carlson M. Analysis of 429 fractures in 189 battered children. *J. Pediatr. Orthop.* 1988; **8**: 585-9.
- 12 Sen S, Rawlinson A. Fractures in children under 3 years of age. *Arch. Dis. Child.* 2001; **84** (Suppl.1): A38.
- 13 Dalton HJ, Slovis T, Helfer RE, Stock J, Scheurer S, Riolo S. Undiagnosed abuse in children younger than 3 years with femoral fracture. *AJDC* 1990; **144**: 875-8.
- 14 Beals RK, Tufts E. Fractured femur in infancy. The role of child abuse. *J. Pediatr. Orthop.* 1983; **3**: 583-6.
- 15 Gross RH, Stanger M. Causative factors responsible for femoral fractures in infants and young children. *J. Pediatr. Orthop.* 1983; **3**: 341-3.
- 16 Kleinman PK. Differential diagnosis III. Accidental and obstetric trauma. In: Corra E (ed.) *Diagnostic Imaging of Child Abuse*, 2nd edn. St Louis: Mosby, 1998; 214-24.
- 17 Caffey J. Multiple fractures in the long bones of infants suffering from chronic subdural haematoma. *Am. J. Roentgenol.* 1946; **56**: 163-73.
- 18 Kleinman PK, Marks SC, Richmond JM, Blackbourne BD. Inflicted skeletal injury: a postmortem radiologic histopathologic study in 31 infants. *Am. J. Roentgenol.* 1995; **165**: 647-9.
- 19 Helfer RE, Slovis TL, Black M. Injuries resulting when children fall out of bed. *Pediatrics* 1977; **60**: 533-5.
- 20 Nimityongskul P, Anderson LD. The likelihood of injuries when children fall out of bed. *J. Pediatr. Orthop.* 1987; **7**: 184-6.
- 21 Lyons TJ, Oates RK. Falling out of bed. A relatively benign occurrence. *Pediatrics* 1993; **92**: 125-7.
- 22 Akbarnia B, Tory JS, Kirkpatrick J, Sussman S. Manifestations of the battered child syndrome. *J. Bone Joint Surg.* 1974; **56**: 1159-66.
- 23 O'Neill JA, Meacham WF, Griffin PP, Sawyers JL. Patterns of injury in the battered child syndrome. *J. Trauma* 1973; **13**: 332-4.
- 24 Galleno H, Oppenheim WL. The battered child syndrome revisited. *Clin. Orthop.* 1982; **162**: 11-19.
- 25 Schwend RM, Werth C, Johnson A. Femur shaft fractures in toddlers and young children. *J. Pediatr. Orthop.* 2000; **20**: 475-81.
- 26 Kleinman PK, Marks SC, Blackbourne B. The metaphyseal lesion in abused infants: a radiologic-histopathologic study. *AJR* 1986; **146**: 895-905.
- 27 Kemp HC, Silverman FN, Steele BF, Droegemueller W, Silver HK. The battered child syndrome. *JAMA* 1962; **181**: 17-24.
- 28 Alexander RC. Education of the physician in child abuse. *Pediatr. Clin. North Am.* 1990; **37**: 971-86.
- 29 Johnson CF, Apolo J, Joseph J, Corbitt T. Child abuse diagnosis and the Emergency Department. *Pediatr. Emerg. Care* 1986; **2**: 6-9.
- 30 Christopher WC, Anderson D, Gaetner C, Roberts D, Wasser TE. Childhood injuries and the importance of documentation in the Emergency Department. *Pediatr. Emerg. Care* 1995; **11**: 52-7.
- 31 Boyce MC, Methorn KJ, Vargo G. Paediatric trauma documentation. Adequacy for assessment of child abuse. *Arch. Pediatr. Adolesc. Med.* 1996; **150**: 730-2.