



Background

-Occult fractures are fractures that are not visible on initial radiographs. They may be accompanied by a so-called 'fat pad sign'.

-A fat pad sign is the visualization of the elbow fatty tissue as seen in the figure below.

- In children with a positive fat pad sign various occult fracture rates and fracture distributions have been reported



Objectives

(1) To calculate an occult elbow fracture rate from published studies of children with a positive fat pad sign without a visible fracture on elbow radiographs.

(2) Secondary objectives were to assess the locations of fractures responsible for a positive fat pad sign and to identify risk factors of occult fractures.

Methods

- A systematic search of the EMBASE, MEDLINE, and Cochrane databases was performed by two independent reviewers

- Studies on paediatric populations with a positive fat pad sign identified by a lateral elbow radiograph and with follow-up imaging by radiograph, MRI or CT were included in this meta-analysis.

Results

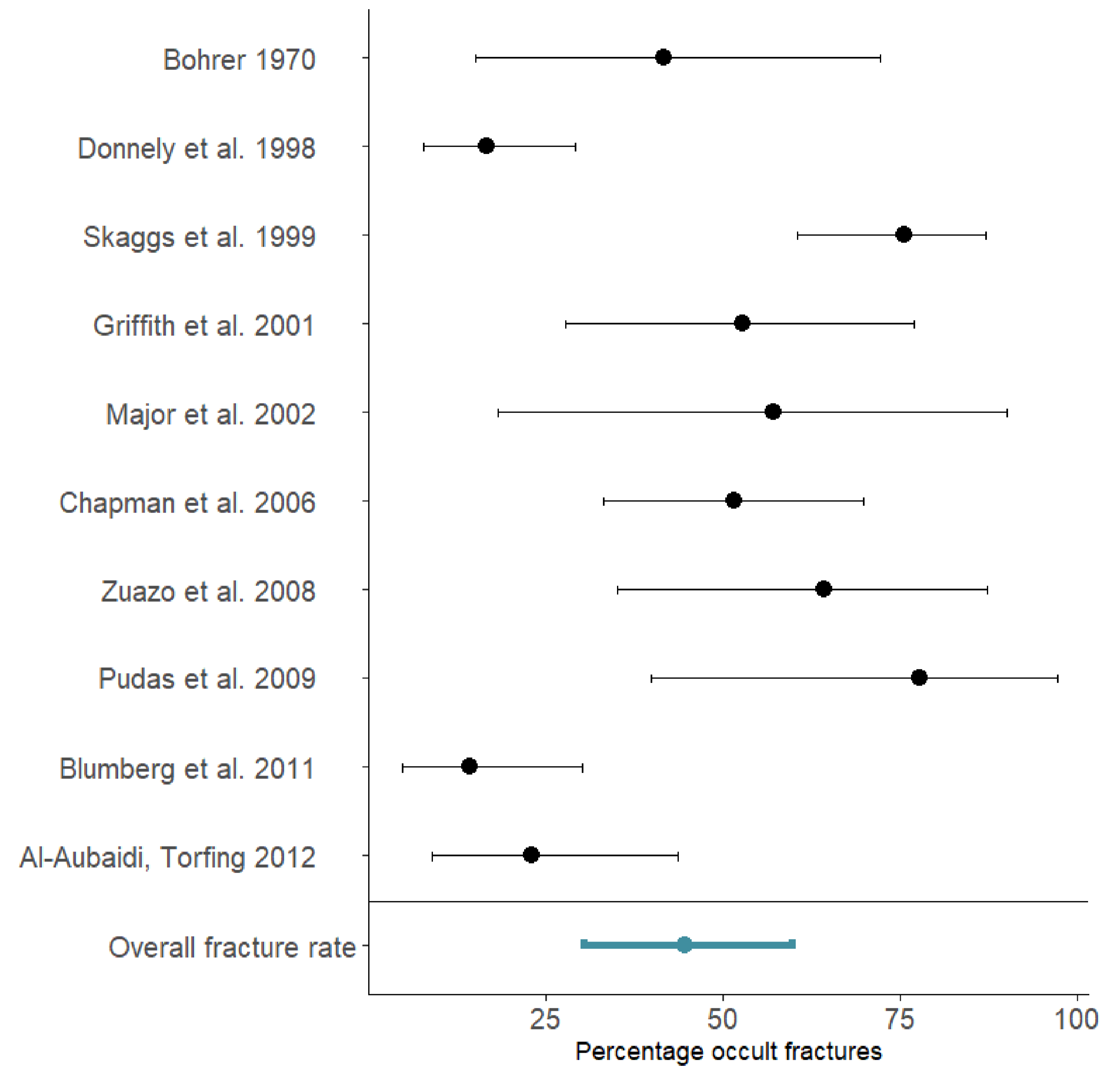
- Initial search yielded 365 articles of which 10 were included for meta-analysis

- The overall percentage of occult fractures was 44.6% (95% CI: 30.4%-59.7%)

1. Occult fracture rate of included studies

Study	Number of patients with a positive fat pad (n)	Number of occult fractures (n)	Occult fracture rate (%)	95 % CI Lower limit	95% CI upper limit
Bohrer, 1970	12	5	41.7	15.2	72.3
Donnelly et al. 1998	54	9	16.7	7.9	29.3
Skaggs et al. 1999	45	34	75.6	60.5	87.1
Griffith et al. 2001	17	9	52.9	27.8	77.0
Major et al. 2002	7	4	57.1	18.4	90.1
Chapman et al. 2006	31	16	51.6	33.1	69.8
Zuazo et al. 2008	14	9	64.3	35.1	87.2
Pudas et al. 2009	9	7	77.8	40.0	97.2
Blumberg et al. 2011	35	5	14.3	4.8	30.3
Al-Aubaidi, Torfing. 2012	26	6	23.1	9.0	43.6
Total	250	104	46.1	30.4	59.7

2. Forest plot of occult fracture rate of included studies



- 9 out of 10 studies recorded locations of the occult fractures. The most common fracture locations were:

1. supracondylar humerus (43%),
2. proximal ulna (19%)
3. proximal radius (17%)
4. lateral humeral condyle (14%).

3. Occult fracture locations of included studies

Study	Supracondylar	Proximal ulna	Proximal radius	Lateral condyle	Medial epicondyle	Coronoid process	Medial condyle	Lateral epicondyle	Total
Donnelly et al. 1998	5	1	2	0	0	1	0	0	9
Skaggs et al. 1999	18	9	3	4	0	0	0	0	34
Griffith et al. 2001	1	2	1	4	0	0	1	0	9
Major et al. 2002	0	0	1	0	3	0	0	0	4
Chapman et al. 2006	5	2	5	2	1	0	0	0	7
Zuazo et al. 2008	2	3	4	0	0	0	0	0	9
Pudas et al. 2009	2	1	0	2	0	0	0	1	15
Blumberg et al. 2011	4	0	0	1	0	0	0	0	5
Al-Aubaidi, Torfing. 2012	2	1	1	1	0	1	0	0	6
Total	43	19	17	14	4	2	1	1	100

- We were not able to identify risk factors for an occult fracture due to insufficient data.

Conclusions

The occult fracture rate in the paediatric population with a positive fat pad sign on standard elbow radiographs is 44,6% .

The most frequently reported fracture locations were the supracondylar humerus (43%), proximal ulna (19%), proximal radius (17%) and lateral humeral condyle (14%) .

Clinical implication

Almost half of all children get unnecessary treatment, while others may receive undertreatment in case of certain types of fractures. Further studies with advanced imaging and on risk factors may contribute to future guideline on treating children with a positive fat pad sign without a fracture on initial radiograph.

