

LETTER TO THE EDITOR

Acceptable angulation of forearm fractures in children



Angulación aceptable de las fracturas de antebrazo en niños

Dear Editor,

Recently, we have witnessed the increasing use of surgical treatment of forearm fractures in children. Although older surgeons tend not to operate on what does not need to be operated on, younger surgeons are increasingly resorting to surgical methods. Disagreements can often be noticed among colleagues about the indication when surgical treatment should be approached. In addition to disagreements in the choice between conservative and surgical treatment, we are increasingly noticing disagreements in the conservative approach. In some cases, some advocate closed reduction, while others do not. Other centres are also recording an increase in surgical treatment, but at the same time there is an increase in the number of complications.¹ Studies have shown an increase in delayed union, the need to frequently expose the fracture site, and wound problems.^{2,3} Rates of superficial infections are significantly more common than deep ones, which are associated with open fractures.

Postoperative neuropraxia usually occurs transiently, without permanent deficits. Delayed union are more common in adolescents than in younger children. Neither the possibility of Extensor Pollicis Longus (EPL) rupture nor the possibility of postoperative compartment syndrome should be neglected.^{4–6} Generally, as greater indications for surgery are unstable and irreducible fractures, open fractures, fractures with neurovascular compromise, pathologic fractures and forearm fractures with associated humerus fracture (“floating elbow”).⁷ While there is no doubt that surgical techniques have brought advances in the treatment of forearm fractures in children, we need to know when there is an indication for the same. We must not forget that any bone manipulation in childhood requires general anaesthesia, which should be avoided if we do not have a clear indication. It is also important to note that surgical treatment, and consequently possible complications, is much more financially expensive than a conservative approach.

Based on evidence-based medicine, we approached the PubMed database search using the following terms: (angulat* OR angle) AND (accept* OR tolera*) AND fracture AND (child* OR paediatric* OR paediatric*) AND (forearm OR radius OR ulna). Reading the articles, we selected those of interest that clearly indicate to us within which values it is not necessary to resort to closed reduction or surgical treatment (Table 1).

Table 1 Acceptability for conservative (non-closed reduction and non-operative) treatment of forearm fractures in children.

Authors (year)	Fracture location	Gender and age	Acceptability
Ho CA (2021) ⁸	Diaphyseal forearm fractures	Girls: <8 years of age Boys: <10 years of age Girls and boys: 2 years of growth remains	15 Degrees of angulation, 1 cm of bayonet apposition Complete bayonet apposition and 10 degrees of angulation in proximal diaphyseal fractures and 15 degrees of angulation in distal diaphyseal fractures
Noonan KJ and Price CT (1998) ⁹	Forearm and distal radius fractures	Girls and boys: <9 years of age Girls and boys: >9 years of age Girls and boys: 2 years of growth remains	Complete displacement, 15 degrees of angulation, 45 degrees of malrotation 30 Degrees of malrotation, 10 degrees of angulation for proximal fractures, 15 degrees for more distal fractures 5 Degrees of angulation and no malrotation

<https://doi.org/10.1016/j.recot.2022.06.003>

1888-4415/© 2022 SECOT. Published by Elsevier España, S.L.U. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Table 1 (Continued)

Authors (year)	Fracture location	Gender and age	Acceptability
Zionts LE et al. (2005) ¹⁰	Diaphyseal forearm fractures	Girls: >8 years of age Boys: >10 years of age	Even in the presence of 100% bayonet apposition, up to 15 degrees of angulation
Greig D and Silva M (2021) ¹¹	Distal radius fractures	Girls: 11–14 years of age Boys: 13–15 years of age	15 Degrees of angulation
Orland KJ et al. (2020) ¹²	Distal radius fractures	Girls and boys: <10 years of age	20 Degrees of angulation, shortening less than 1 cm
Wacker EM et al. (2019) ¹³	Radius fractures	Girls: <8 years of age Boys: <10 years of age	20 Degrees in the distal third, 15 degrees in the middle third, 10 degrees in the proximal third
Roth KC et al. (2014) ¹⁴	Distal forearm fractures (if re-angulation occurs)	Girls: >8 years of age Boys: >10 years of age	10 Degrees regardless of fracture level
		Girls and boys: <9 years of age	30 Degrees of angulation
		Girls and boys: 9–12 years of age	25 Degrees of angulation
		Girls and boys: >12 years of age	20 Degrees of angulation

If we adhere to the above data, the need for closed reductions and operative treatments will undoubtedly be reduced in everyday practice, with an equally functional outcome and less stress for the child.

Level of evidence

Level of evidence III.

Conflict of interest

The author declares that have no conflicts of interest.

References

1. Flynn JM, Jones KJ, Garner MR, Goebel J. Eleven years experience in the operative management of pediatric forearm fractures. *J Pediatr Orthop*. 2010;30:313–9, <http://dx.doi.org/10.1097/BPO.0b013e3181d98f2c>.
2. Lascombes P, Haumont T, Journeau P. Use and abuse of flexible intramedullary nailing in children and adolescents. *J Pediatr Orthop*. 2006;26:827–34, <http://dx.doi.org/10.1097/01.bpo.0000235397.64783.d6>.
3. Cullen MC, Roy DR, Giza E, Crawford AH. Complications of intramedullary fixation of pediatric forearm fractures. *J Pediatr Orthop*. 1998;18:14–21.
4. Lee AK, Beck JD, Mirenda WM, Klena JC. Incidence and risk factors for extensor pollicis longus rupture in elastic stable intramedullary nailing of pediatric forearm shaft fractures. *J Pediatr Orthop*. 2016;36:810–5, <http://dx.doi.org/10.1097/BPO.0000000000000568>.
5. Yuan PS, Pring ME, Gaynor TP, Mubarak SJ, Newton PO. Compartment syndrome following intramedullary fixation of pediatric forearm fractures. *J Pediatr Orthop*. 2004;24:370–5, <http://dx.doi.org/10.1097/00004694-200407000-00005>.
6. Martus JE, Preston RK, Schoenecker JG, Lovejoy SA, Green NE, Mencio GA. Complications and outcomes of diaphyseal forearm fracture intramedullary nailing: a comparison of pediatric and adolescent age groups. *J Pediatr Orthop*. 2013;33:598–607, <http://dx.doi.org/10.1097/BPO.0b013e3182a11d3b>.
7. Poutoglidou F, Metaxiotis D, Kazas C, Alvanos D, Mpeletsiotis A. Flexible intramedullary nailing in the treatment of forearm fractures in children and adolescents, a systematic review. *J Orthop*. 2020;20:125–30, <http://dx.doi.org/10.1016/j.jor.2020.01.002>.
8. Ho CA. Radius shaft fractures – what alignment is acceptable at what age? Plates or flexible nails? *J Pediatr Orthop*. 2021;41 Suppl 1:S14–9, <http://dx.doi.org/10.1097/BPO.0000000000001775>.
9. Noonan KJ, Price CT. Forearm and distal radius fractures in children. *J Am Acad Orthop Surg*. 1998;6:146–56, <http://dx.doi.org/10.5435/00124635-199805000-00002>.
10. Zionts LE, Zalavras CG, Gerhardt MB. Closed treatment of displaced diaphyseal both-bone forearm fractures in older children and adolescents. *J Pediatr Orthop*. 2005;25:507–12, <http://dx.doi.org/10.1097/01.bpo.0000158005.53671.c4>.
11. Greig D, Silva M. Management of distal radius fractures in adolescent patients. *J Pediatr Orthop*. 2021;41 Suppl 1:S1–5, <http://dx.doi.org/10.1097/BPO.0000000000001778>.
12. Orland KJ, Boissonneault A, Schwartz AM, Goel R, Bruce RW Jr, Fletcher ND. Resource utilization for patients with distal radius fractures in a pediatric emergency department. *JAMA Netw Open*. 2020;3:e1921202, <http://dx.doi.org/10.1001/jamanetworkopen.2019.21202>.
13. Wacker EM, Denning JR, Mehlman CT. Pediatric proximal radial shaft fractures treated nonoperatively fail to maintain acceptable reduction up to 70% of the time. *J Orthop Trauma*. 2019;33:e378–84, <http://dx.doi.org/10.1097/BOT.0000000000001516>.
14. Roth KC, Denk K, Colaris JW, Jaarsma RL. Think twice before re-manipulating distal metaphyseal forearm fractures in children. *Arch Orthop Trauma Surg*. 2014;134:1699–707, <http://dx.doi.org/10.1007/s00402-014-2091-8>.

M. Bašković

Department of Pediatric Surgery, Children's Hospital Zagreb, Ulica Vjekoslava Klaića 16, 10000 Zagreb, Croatia
E-mail address: baskovic.marko@gmail.com