

Bone Fragility in Medically Complex Children: Identifying Risks and Improving Care

Gianni Terrana PT, DPT & Lucia Mathis MOT, OTR/L • Silver State Pediatric Skilled Nursing Facility • Las Vegas, Nevada



Scan to learn more about SSP
www.silverstatepediatricsnf.com

BACKGROUND

Children with medical complexity (CMC) residing in long-term or post-acute care settings frequently experience compromised bone health due to underlying conditions that restrict independent mobility and weight-bearing. Their increased risk for bone fragility stems from a complex interplay of metabolic disturbances, chronic administration of antiepileptics, non-weight-bearing status, insufficient vitamin D levels, and nutritional barriers such as malabsorption. Consequently, these children are highly vulnerable to **sustaining fractures during routine, low-force daily care activities such as bathing, dressing, or transferring.**

While non-traumatic femur fractures serve as a strong clinical indicator of potential child abuse in typical, ambulatory children, they are a known and expected complication of low bone mass in the CMC population. Failing to recognize this physiological difference frequently results in unwarranted child protective services investigations, which can stigmatize devoted caregivers and severely damage vital partnerships between families and healthcare teams.

PURPOSE

To improve clinical recognition of the unique fracture patterns inherent to this medically fragile population, specifically highlighting the high prevalence of non-traumatic distal femur fractures.

To redirect clinical conversations regarding non-traumatic fractures in CMC away from suspicions of child abuse, especially in long-term residents in post-acute settings.

This poster facilitates a collaborative approach to fracture prevention that protects residents, while strengthening trust and therapeutic relationships with caregivers.

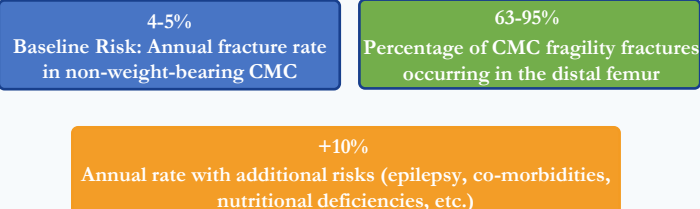
METHODS

A comprehensive literature review was conducted to identify evidence-based data regarding bone health in CMC residing in post-acute care settings. The review specifically focused on identifying the risk factors associated with fragility-related fractures within this unique demographic. This project also synthesized the available evidence-based recommendations being utilized by clinical experts in the field to formulate actionable protocols for mitigating fracture risk in CMC.

REFERENCES

- Fehlings, D., Switzer, L., Agarwal, P., Wong, C., Sochetti, E., Stevenson, R., Sonnenberg, L., Smile, S., Young, E., Huber, J., Milo-Manson, G., Kuwaik, G. A., & Gaebler, D. (2012). Informing evidence-based clinical practice guidelines for children with cerebral palsy at risk of osteoporosis: A systematic review. *Developmental Medicine and Child Neurology*, 54(2), 106–116. <https://doi.org/10.1111/j.1469-8749.2011.04091.x>
- Houlihan, C. M., & Stevenson, R. D. (2009). Bone density in cerebral palsy. *Physical Medicine and Rehabilitation Clinics of North America*, 20(3), 493–508. <https://doi.org/10.1016/j.pmr.2009.04.004>
- Kim, C., & Park, H. (2024). Evidence-based clinical guidelines for optimizing the use of standing frame: A systematic review of dosing recommendations among cerebral palsy. *Physical Therapy Korea*, 31(2), 131–141. <https://doi.org/10.12674/ptk.2024.31.2.131>
- McLean, L. J., Paleg, G. S., & Livingstone, R. W. (2023). Supported-standing interventions for children and young adults with non-ambulant cerebral palsy: A scoping review. *Developmental Medicine and Child Neurology*, 65(6), 754–772. <https://doi.org/10.1111/dmcn.15435>
- Mergler, S., Evenhuis, H. M., Boot, A. M., De Man, S. A., Bindels-De Heus, K. G., Huijbers, W. A., & Penning, C. (2009). Epidemiology of low bone mineral density and fractures in children with severe cerebral palsy: A systematic review. *Developmental Medicine and Child Neurology*, 51(10), 773–778. <https://doi.org/10.1111/j.1469-8749.2009.03384.x>
- Stevenson, R. D., Conway, M., Barrington, J. W., Cuthill, S. L., Worley, G., & Henderson, R. C. (2006). Fracture rate in children with cerebral palsy. *Pediatric Rehabilitation*, 9(4), 396–403. <https://doi.org/10.1080/13638490600668061>
- Vincent, B., Goeb, V., Fritot, S., Romuald, M., Sobhy-Daniail, J. M., Fardellone, P., & Le Monnier, L. (2022). Effect of standing frames used in real life on bone remodeling in non-walking children with cerebral palsy. *Annals of the Rheumatic Diseases*, 81, 1207. <https://doi.org/10.1136/annrheumdis-2022-eular.145>
- Whitney, D. G., Hurvitz, E. A., & Caird, M. S. (2021). Critical periods of bone health across the lifespan for individuals with cerebral palsy: Informing clinical guidelines for fracture prevention and monitoring. *Bone*, 150, 116009. <https://doi.org/10.1016/j.bone.2021.116009>

RESULTS: Incidence of Fragility Fractures in CMC



A pediatric osteoporosis diagnosis requires both a clinically significant fracture history of two or more long bone fractures, as well as a DXA score ≤ -2.0 . Annual fracture rates in non-weight-bearing CMC are 4-5%, escalating to nearly 10% in those with concurrent epilepsy, co-morbidities, and nutritional deficiencies. Unlike ambulatory children where non-traumatic fractures are highly suspect for abuse, 63% to 95% of fragility fractures in non-weight-bearing CMC occur in the distal femur. Misattributing these expected fragility fractures to abuse prompts unwarranted child protective services referrals, which is a detriment to long-standing therapeutic relationships.

RESULTS: Fragility Fracture Prevention Strategies



CONCLUSIONS

This project summarizes the limited, available evidence to support bone health evaluation and fracture risk reduction in post-acute pediatric settings. Recognizing the risk factors is vital to prevent fragility-related fractures, as well as the stigma behind fractures occurring in atypical, non-weight-bearing CMC. By shifting the clinical focus toward proactive, interdisciplinary interventions, providers can safely reduce fracture incidence while fostering trusting relationships with other caregivers.

IMPLICATIONS FOR PRACTICE

Implement supported standing frames or gait trainers for targeted weight-bearing for 30 to 60 minutes, 5 days per week to build bone density.

Use the scoop technique or mechanical lift for safe transfers.

Routinely assess fracture risk by evaluating non-weight bearing status, history of seizure medication, and nutritional challenges.

Utilize the DXA as the preferred assessment method, especially if the child has had previous fragility related fractures.

Refer high-risk CMC to an interdisciplinary team: neurology, orthopedics, endocrinology, therapy, and a registered dietitian.

Ensure all CMC that are g-tube reliant are evaluated to manage bone health nutrients such as calcium, phosphorus, and vitamin D.

Consider bisphosphonate therapy for children with ≥ 2 long bone/vertebral fractures or a rapid decline in bone mineral density.

Recognize that in the absence of other trauma, distal femur and proximal tibia fractures are complications of CMC and should not prompt a negative stigma.



Silver State Pediatric Skilled Nursing Facility • Las Vegas, Nevada •
www.silverstatepediatricsnf.com