

Surgeon Preference is Highly Influenced by Age When Deciding on Nail Implant Design in Pediatric Tibia Fractures

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Background

- Tibial shaft fractures are the third most common pediatric fracture [1,2] and are the second most common reason for orthopedic inpatient admission to children's hospitals. [3-6]
- Although casting is the mainstay for treatment of pediatric tibial shaft fractures, there has been an increasing trend toward operative management for displaced, rotated or length unstable fractures. (6, 15)
- The primary modality for operative management remains intramedullary fixation.
- There is often debate in terms of when can a pediatric patient receive more "adult-like" trauma care for these tibia fractures.
- The purpose of this study was to determine the impact of chronological age and gender on type of intramedullary implant choice when operative stabilization is performed for pediatric tibial fractures.

Methods

- We conducted retrospective review of 214 patients aged 6-18 years, treated with IMN for tibial shaft fractures (CPT code 27759), over a nine-year period at three pediatric centers.
- We captured treatment-related data and post-operative data including length of follow up, presence of complications, unplanned return to the operating room (ROR), and radiographic evidence of union.
- We used ROC analysis to determine clinical consensus by identifying which nail design was used for each age/ gender dyad.
- Multivariate analysis was undertaken to understand the effect of additional factors which could confound the effect of the decision to treat with flexible nails versus rigid nails.

Study Consort Diagram

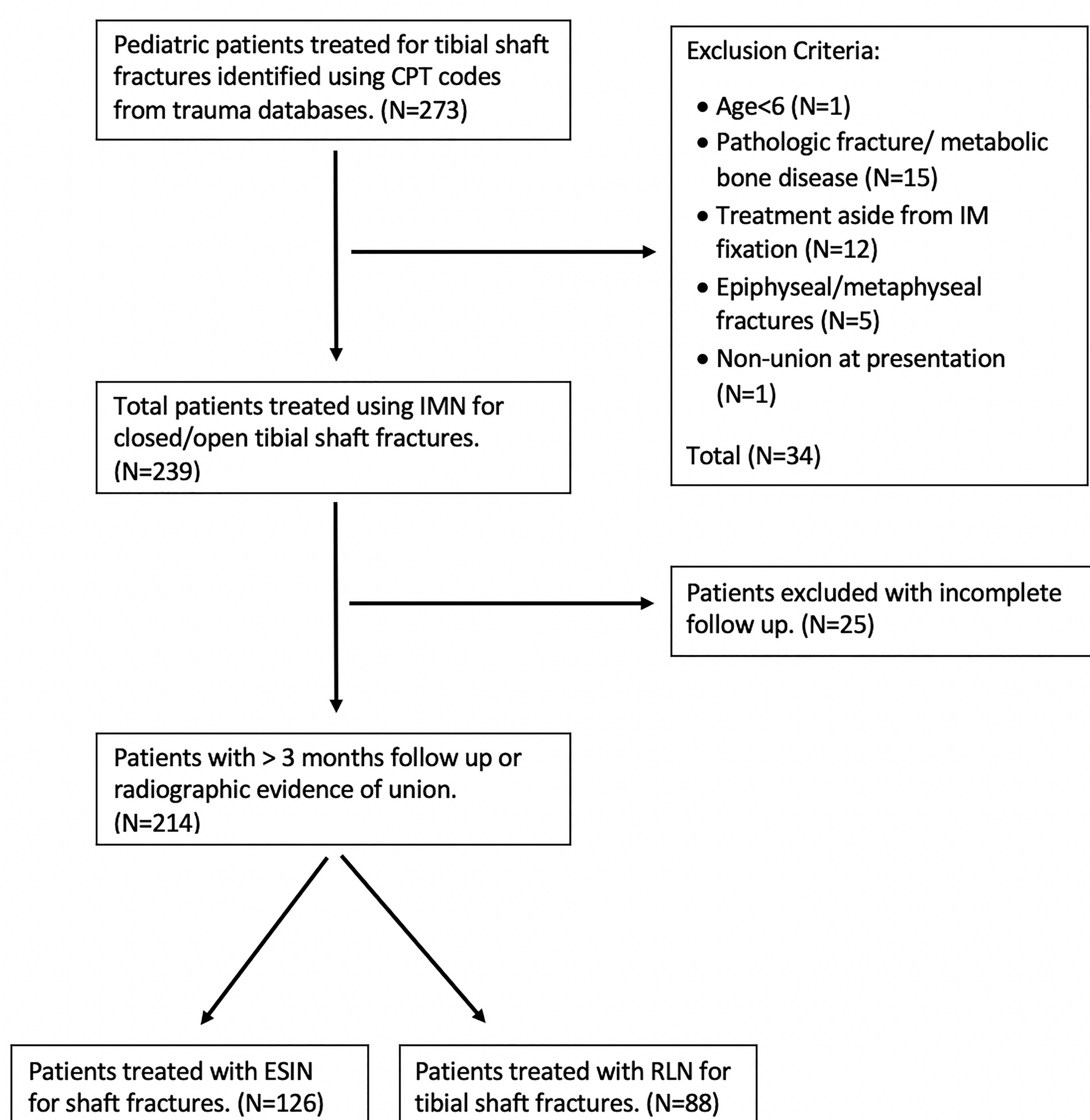


Figure 1

*IMN-intramedullary nail, ESIN-elastic stable intramedullary nail, RLN- rigid locked nail

Results

- ROC analysis revealed in males the age of inflection for change in nail design was 14.75 years in males and 13.5 years in females
- Regression analysis showed that age and gender were significant independent predictors of nail selection.
- Weight was a significant independent predictor for males only.
- Area under the curve for prediction of nail choice using age and gender resulted in high predictive ability AUC 0.94 for males (p <0.001) and AUC 0.95 for females (p <0.001).

Results

Consensus Trends of Nail Type by Gender and Age (P<0.001)
(a) Total cohort population, (b) Male population, (c) Female population

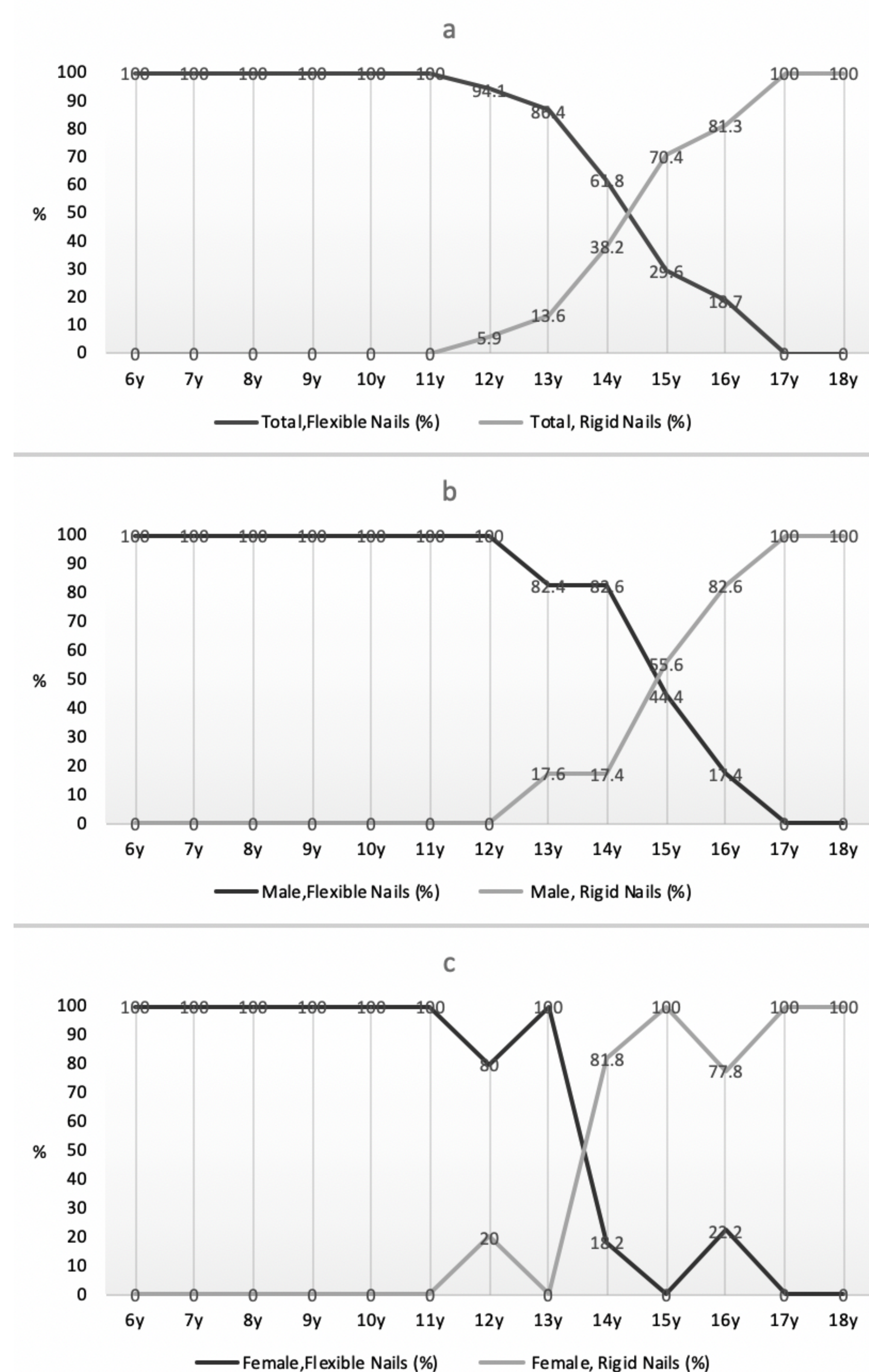


Figure 2

Consensus Trends of Nail Type by Weight (P<0.001)

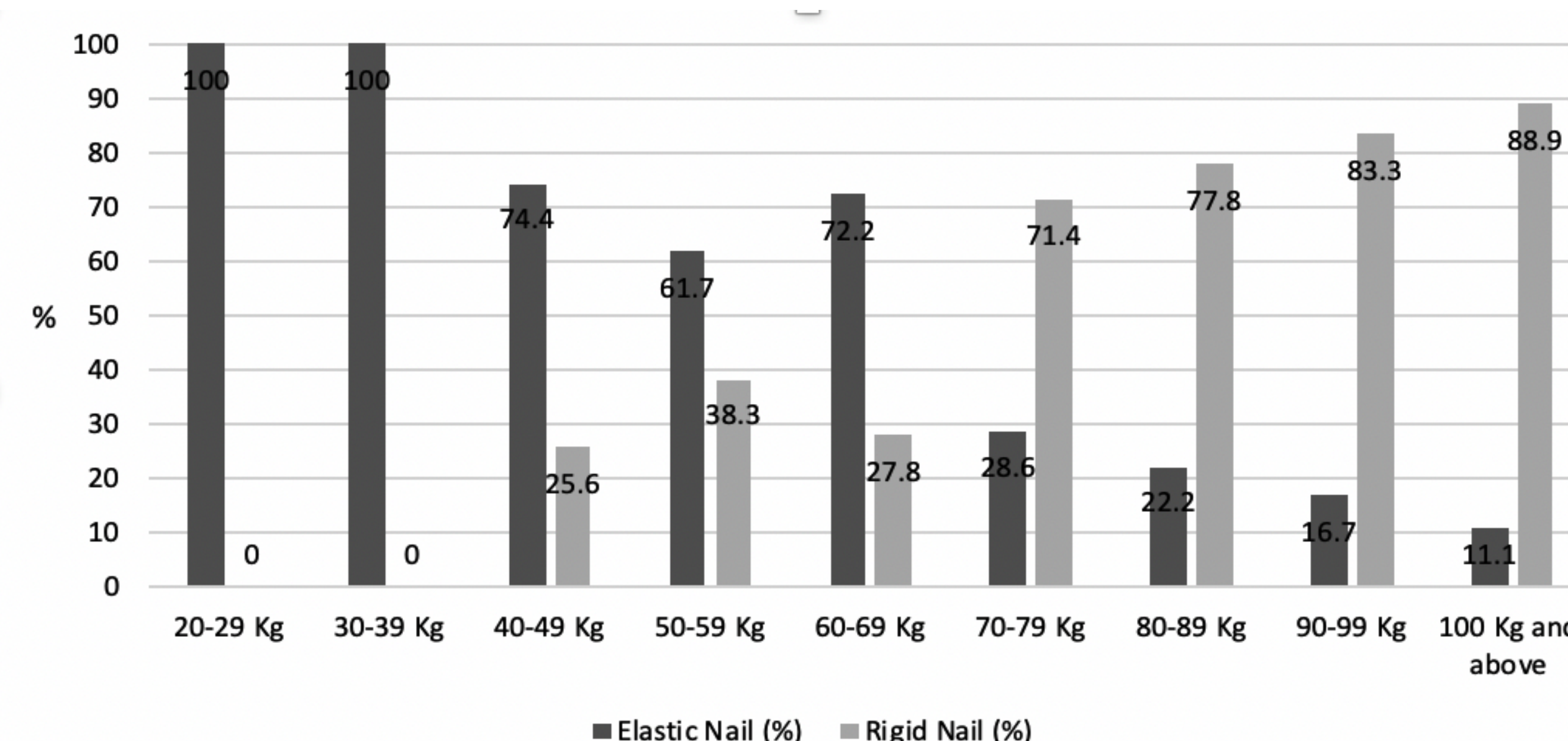


Figure 3

Discussion

- Our study showed that age and gender alone were highly effective at predicting nail preference in a multicenter setting.
- Results showed that presence of open fracture and higher-energy fracture were not significant factors for implant choice (p=0.17, p=0.87 respectively)
- When weight was combined in this analysis, we found that for males especially, the addition of weight contributed significantly to predicting RLN use
- Limitations of this study include its retrospective nature, limited follow-up time, and potentially not including all parameter which go into the decision of nail type for each surgeon.
- This study identified inflection points and speaks to surgeons' preferences in treatment for different age groups when an intramedullary strategy is selected.

Recommendations for Nail Type Selection by Gender and Age (years)

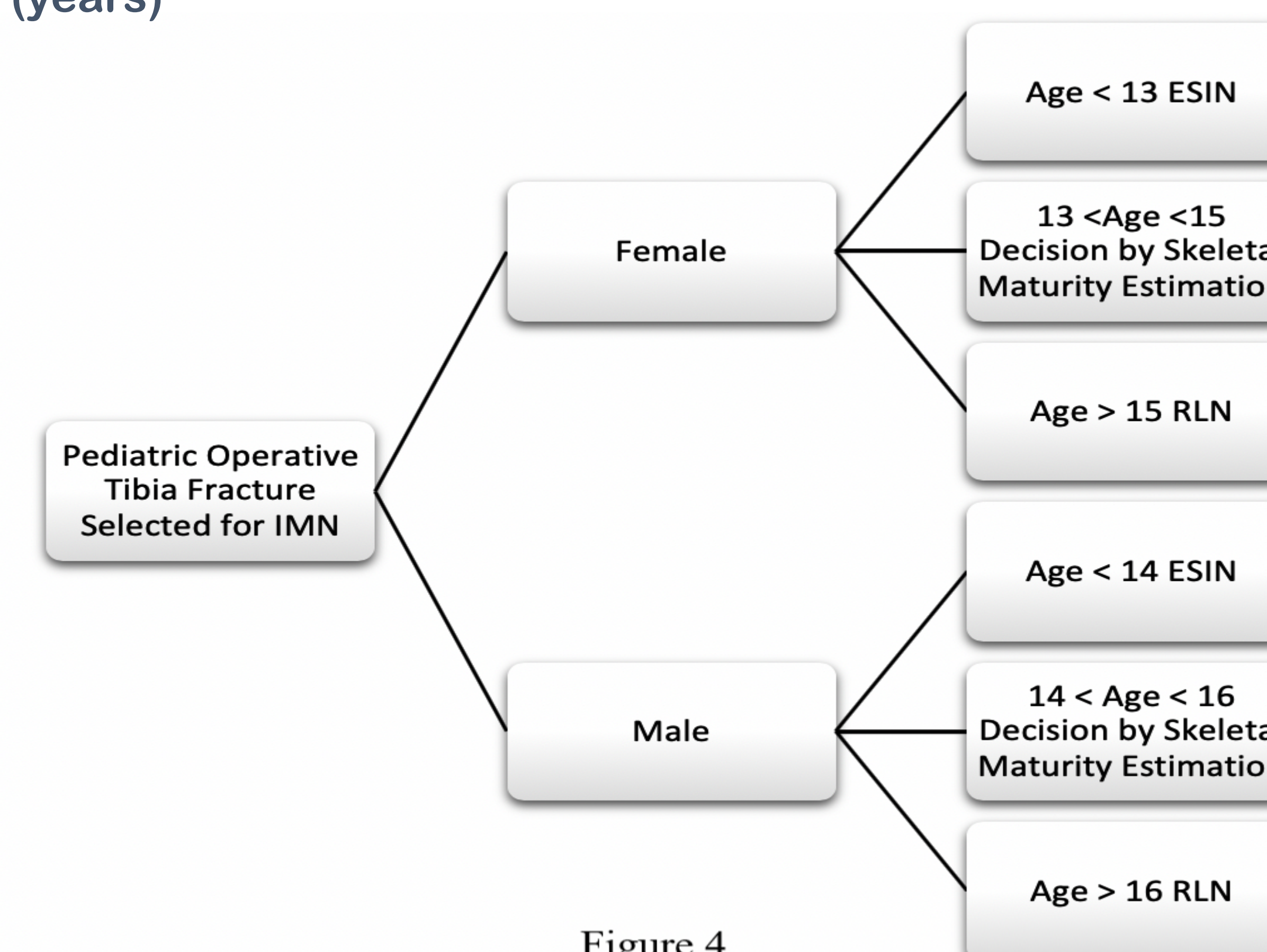


Figure 4

*IMN-intramedullary nail, ESIN-elastic stable intramedullary nail, RLN-rigid locked nail

Conclusions

- Males under 14 years of age and females under 13 years of age routinely receive ESIN, whereas males over age 16 years and females over age 15 years routinely receive RLN.
- For children between these ages, although there is a clear inflection point in the preferred treatment, we recommend obtaining skeletal maturity studies to assist this decision, and if there is any doubt, until data presents itself to the contrary, elastic nails are likely the safer implant.

References

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