INTRODUCTION

- The size of secondary osteons varies considerably between individuals, though the factors acting to define osteon size remain uncertain.
- Understanding the biological mechanisms that act in remodeling and determine osteon size is essential for accurately addressing and interpreting histological findings.
- The aim of this study is to explore multiple factors currently thought to influence osteon size in an attempt to better understand mechanisms influencing the remodeling process. Specifically, we test the premise that sex, age, cortical area, porosity, and local loading environment have a significant effect on osteon area in the human rib.

MATERIALS AND METHODS

- The sample is composed of 80 individuals: 40 male and 31 female, between 8-94 years of age (mean = 59.9 years, age range 23.5 years). Complete cross-sections were taken at the lateral or midshaft of the 6th rib and slides were prepared following standard histological protocols. All slides were photographed at 40X magnification and all data were collected using ImageJ.
- Ribs were photographed and then digitally bisected into pleural and cutaneous regions for data collection (defined by Im). Variables collected are listed in Table 1. All variables were manually collected using scaled images and a digitizing tablet (Fig. 1). Only intact osteons, defined by an intact reversal line, were measured to establish mean On.Ar. All pores were measured to calculate Po.Ar, excluding the mediolateral cavity and ostearthritic lacunae.
- Natural log transformation was applied to Pl.On.Ar, %Cu.Ct.Ar, %Po.Ar, %Cu.Po.Ar, and %Pl.Po.Ar and the normalized values were used for all analyses. Independent sample t-tests were used to compare On.Ar between sexes. Paired sample t-tests were used to compare On.Ar between the cutaneous and pleural cortices of the rib specifically.

RESULTS AND DISCUSSION

- Descriptive statistics for the histomorphometric variables by cortex are given in Tables 2a-c.
- Independent sample t-tests indicated no significant differences in On.Ar between males and females. Samples were pooled for all further analyses.
- Paired sample t-tests showed that there were significant differences between cortices in On.Ar, %Ct.Ar, and %Po.Ar.
- HMR revealed that age and %Ct.Ar have a significant influence on On.Ar, while %Po.Ar does not (Table 3). These results held true whether looking at the total cortex or at the cutaneous and pleural cortices independently.

CONCLUSIONS

- Osteon size in the rib is largely influenced by chronological age and to a lesser extent by available Ct.Ar, while sex and %Po.Ar do not appear to play a significant role.
- While the factors outlined here as influencing On.Ar are important considerations, recent evidence suggests that genetic effects may be the primary force defining osteon size. Recent studies suggest that up to 60% of remodeling differences may be due to genetic factors (Bjørnerem et al. 2015). As such, further research is warranted.

REFERENCES CITED


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