Child Abuse: Understanding the Biomechanics of Rib Fractures in Infants

By

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To help speak for those who cannot...

Abstract

There are some general assumptions made by forensic paediatricians and pathologists about how infants in child abuse cases suffer fractured ribs; the main assumption being that rib fractures are resultant from ‘shaken baby syndrome’. There have been many studies on the biomechanics of rib fractures in adults and the different modes through which these occur, but there has been no scientific research conducted on the biomechanics of rib fractures in infants or children. There are two main aims to this study; firstly, to assess the biomechanical properties of immature piglet ribs and compare these results with published literature on adult pig ribs and secondly, to compare and contrast the fracture patterns of immature piglet ribs in three categories: dry, frozen then thawed, and fresh. Piglet ribs were taken from still born or day-old piglets and tested in the three different categories and two different protocols for stress, strain, modulus, and maximum load measurements. Scanning Electron Microscopy and micro-CT scanning were the imaging techniques used to examine morphological differences between the three categories. It was found that the dry samples had catastrophic breaks that followed a straight and then oblique fracture pattern, whereas the fractures observed in the frozen and thawed samples were straight, incomplete fractures. Fresh samples did not fracture. Statistically significant differences were found between each of the three categories; in particular the frozen then thawed ribs produced greater biomechanical results than the fresh ribs which were expected to be similar in response. This suggests that using freezing as a storage method significantly alters the biomechanical analysis

The present study seriously challenges the current dogma on shaken baby syndrome in the literature, and suggests that rib fractures do not occur during compressive loading of the rib cage in infants due to the very high plasticity and partial bony development.

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Table of Contents

Abstract... iii

Acknowledgements... iv

List of Figures.. ix

Chapter One: Introduction... 1

Chapter Two: Literature Review.. 5

2.1. Bone Structure.. 5

2.1.1 Intramembranous ossification.. 6

2.1.2 Endochondral ossification... 7

2.1.3 Types of bone... 9

Compact Bone.. 10

Woven Bone.. 10

Lamellar Bone... 11

Cancellous Bone.. 13

Anatomical differences between adult and juvenile ribs.............................. 14

Bone architecture of the domestic pig, Sus scrofa, as compared to juvenile human bone.. 14

2.1.4 Bone resorption and Wolff's Law... 16

2.1.5 Age... 18

2.1.6 Sex... 19

2.1.7 Bone pathology.. 20

Osteopetrosis... 21

Osteogenesis imperfecta.. 22

Rickets... 23

Osteomalacia... 24

2.2 Biomechanics of Bone.. 24

2.2.1 Concepts of bone biomechanics.. 24

Stress.. 25

Strain.. 26

Tension.. 27

Compression... 29

Shear... 30

Bending.. 31

2.2.2 Biomechanical Studies... 32

2.3 Rib Morphology and Biomechanics.. 33

2.3.1 Rib growth.. 34

2.3.2 Rib Biomechanics.. 34

2.4 Child Abuse and Rib Fractures.. 40

2.4.1 Physical Abuse.. 42

2.4.2 Rib injuries in children.. 44

Dynamic Impact Loading.. 46

Shaken Baby Syndrome... 47

2.4.3 Child Abuse Statistics in New Zealand... 50

2.5 Imaging Techniques.. 53

2.5.1 Scanning Electron Microscopy.. 53

2.5.2 Micro CT Scanning.. 55

2.6 Terminology.. 57

2.7 Conclusion and Aims... 58

Chapter Three: Materials and Methods.. 60

3.1 Materials... 60

3.1.1 Ribs... 60

3.1.2 Testing and Imaging.. 61

3.2 Methods.. 64

3.2.1 Instron Calibration and Adult Rib Testing... 64

3.2.2 Piglet Rib Testing... 65

Dried Ribs 66

Fresh Ribs 67

Thawed Ribs 69

Three-point Bending 69

Statistical Analyses 70

Micro-CT Scanning 71

Scanning Electron Microscopy 72

Chapter Four: Results 73

4.1 Normal Rib Morphology 74

4.2 Biomechanical Analyses 74

4.2.1. Four-point Bending in Adult Ribs 74

4.2.2 Four-Point Bending in Dry Piglet Ribs 77

Protocol One 77

Protocol Two 82

4.2.3. Four-point bending in frozen then thawed piglet ribs 87

Protocol One 87

Protocol Two 93

4.2.4. Four-point bending in fresh ribs 98

Protocol One 98

Protocol Two 104

4.2.5. Three-point bending 110

Dried Ribs 110

Frozen then Thawed Ribs 112

Fresh Rib 114

4.3. Fracture morphology 116

Dried Ribs 116

Frozen then Thawed Ribs 116

Fresh Ribs 117

4.3.1. Dried Ribs.. 118

4.3.2. Frozen then Thawed Ribs.. 123

4.3.3. Fresh Ribs.. 127

4.5. Statistical Analyses.. 130

Strength.. 130

Strain... 131

Modulus.. 132

Maximum Load... 134

Chapter Five: Discussion.. 135

5.1. Introduction.. 135

5.2. Biomechanical Analysis.. 138

Fractography.. 141

Periosteum... 143

Bone Strength and Crack Bridging.. 144

Rib Fractures in Infants: Forensic Implications...................................... 145

Chapter Six: Conclusions.. 147

References.. 148

List of Figures

Figure 2.1 Endochondral ossification process in a long bone (taken from Moss-Salentijn and Hendricks-Klyvert, 1990:98).

Figure 2.2 A histological section depicting spongy woven bone. **P** shows a fibrous layer of periosteum forming which denotes the edge of the system of trabeculae and the outline of the forming bone (taken from Moss-Salentijn and Hendricks-Klyvert, 1990:88).

Figure 2.3 A histological section of compact lamellar bone that shows channels that supply blood and nutrients (large arrows). **A** shows arrest lines and **R** shows evidence of constant remodelling throughout life (taken from Moss-Salentijn and Hendricks-Klyvert, 1990:89).

Figure 2.4 Primary vascular laminar bone tissue from the domestic pig x200 magnification (taken from Martiniaková et al., 2007:84).

Figure 2.5 Primary vascular plexiform bone (taken from Brits, 2009; original from Francillon-Vieillot et al., 1990).

Figure 2.6 Load-deformation curve showing the elastic and plastic strain regions and the yield point for deformation. **X** marks the fracture point. Diagram taken from Turner and Burr (1993:597).

Figure 2.7 Tensile loading (taken from Nordin and Frankel, 2001:37).

Figure 2.8 Compressive loading (taken from Nordin and frankel, 2001:38).

Figure 2.9 Shear loading (taken from Nordin and Frankel, 2001:39).

Figure 2.10 SEM picture showing cracks in the Haversian canal of previously frozen bone (left) and a Haversian canal in a non-frozen bone (right). Pictures taken from Tersigni (2007:18).

Figure 2.11 Diagrammatic representation of the different types of fracture patterns found in young children, (taken from Ogden, 2000:51). **A** represents a longitudinal fracture that typically runs the length of the diaphysis; **B** a transverse fracture that typically breaks at a right angle to the longitudinal axis of the diaphysis; **C** an oblique fracture that can be at a 30° - 40° angle off the longitudinal axis of the diaphysis; **D** a spiral fracture that encircles the diaphysis in a twisting manner; **E** an impacted fracture whereby the cortical and trabecular bone that is located either side of the fracture is essentially crushed together; **F** a comminuted fracture whereby the fracture itself propagates in various directions typically with multiple fragments; **G** a type of plastic deformation where bowing occurs past the point of elastic return; **H** a greenstick fracture in which case the bone is partially fractured but a portion remains intact on the compression side; and **I** a torus fracture that in itself is not an actual fracture, but more a stable impact injury where the bone buckles but does not break (Ogden, 2000).

Figure 2.12 Chest compression through squeezing a child’s rib cage.

Figure 2.13 Representation of the rib cage and its articulation showing the front (anterior) view, the back (posterior) view, and fracture patterns. The black arrows indicate posterior fracture, the red arrows indicate mid-lateral fracture, the blue arrow indicates anterior fracture, and black dotted lines indicate flail chest (taken from http://emedicine.medscape.com).

Figure 2.14 Violent shaking and squeezing of an infant may result in subdural haemorrhage (top right diagram) and shear-type brain injury, rib fracture (middle right diagram), and metaphyseal fracture (lower right diagram) (taken from Lonergan et al., 2003:812).

Figure 2.15 Chris and Cru Kahui. (Taken from http://msn.nzherald.co.nz/nz/news/article).

Figure 2.16 Schematic representation of an SEM (taken from Flegler et al., 1993, pp. 67).

Figure 2.17 A schematic representation of the back-projection process that recreates the original object into a three-dimensional image.

Figure 2.17 A schematic representation of the cross-sectional slices in a vertical direction that produces the Z axis.

Figure 3.1 The seventh piglet rib specimens that had been dried out prior to testing.

Figure 3.2 The scanning electron microscope (Cambridge 360 SEM).

Figure 3.3 SkyScan 1172 micro-CT scanner.

Figure 3.4 The Bal-Tec critical point dryer.

Figure 3.5 Emitech K575X Peliter-cooled high resolution sputter coater.

Figure 3.6 The Instron machine set up for four-point bending (A) and the Bluehill computer Software programme (B).

Figure 3.7 The Instron machine loaded with a dried piglet rib just before testing.

Figure 3.8 A dried rib specimen loaded to failure.

Figure 3.9 A fresh piglet rib bent to an extreme ‘U’ shape without breaking that touched the sides of the loading head distorting stress/strain results.

Figure 3.10 A schematic representation of how the piglet rib was compressed to failure manually.

Figure 3.11 A schematic representation of the three-point bend set up on the Instron machine.

Figure 4.1 Micro-CT view of the normal structure of a piglet rib. The white arrow indicates the lamellar bone while the red arrow indicates the cancellous bone. Note the compact outer cortical surface (left) compared to the thinner cortical table (right) and inner trabeculae of the cancellous compartment.

Figure 4.2 Micro-CT image of an adult pig rib. The red arrow indicates the dense outer trabecular bone and the yellow arrow indicates the thin lamellar bone layer.

Figure 4.3 Force-displacement graph showing how far the cross-head moved during loading of the adult fresh rib specimens.

Figure 4.4 Flexure stress-strain graph for fresh adult pig ribs.

Figure 4.5 Force-displacement graph showing how far the cross-head moved during loading of the 5th dry rib specimens.

Figure 4.6 Flexure stress-strain graph for the 5th dry rib specimens.

Figure 4.7 Force-displacement graph showing how far the cross-head moved during loading of the 6th dry rib specimens.

Figure 4.8 Flexure stress-strain graph for the 6th dry rib specimens.

Figure 4.9 Force-displacement graph showing how far the cross-head moved during loading of the 7th dry rib specimens.

Figure 4.10 Flexure stress-strain graph for the 7th dry rib specimens.

Figure 4.11 Force-displacement graph showing how far the cross-head moved during loading of the 5th dry rib specimens.

Figure 4.12 Force-displacement graph showing how far the cross-head moved during loading of the 6th dry rib specimens.

Figure 4.13 Force-displacement graph showing how far the cross-head moved during loading of the 7th dry rib specimens.

Figure 4.14 Force-displacement graph showing how far the cross-head moved during loading of the 5th frozen then thawed rib specimens.

Figure 4.15 Flexure stress-strain graph for the 5th frozen then thawed rib specimens.

Figure 4.16 Force-displacement graph showing how far the cross-head moved during loading of the 6th frozen then thawed rib specimens.

Figure 4.17 Flexure stress-strain graph for the 6th frozen then thawed rib specimens.

Figure 4.18 Force-displacement graph showing how far the cross-head moved during loading of the 7th frozen then thawed rib specimens.

Figure 4.19 Flexure stress-strain graph for the 7th frozen then thawed rib specimens.

Figure 4.20 Force-displacement graph showing how far the cross-head moved during loading of the 5th frozen then thawed rib specimens.

Figure 4.21 Force-displacement graph showing how far the cross-head moved during loading of the 6th frozen then thawed rib specimens.

Figure 4.22 Force-displacement graph showing how far the cross-head moved during loading of the 7th frozen then thawed rib specimens.

Figure 4.23 Force-displacement graph showing how far the cross-head moved during loading of the 5th fresh rib specimens.

Figure 4.24 Flexure stress-strain graph for the 5th fresh rib specimens.

Figure 4.25 Force-displacement graph showing how far the cross-head moved during loading of the 6th fresh rib specimens.

Figure 4.26 Flexure stress-strain graph for the 6th fresh rib specimens.

Figure 4.27 Force-displacement graph showing how far the cross-head moved during loading of the 7th fresh rib specimens.

Figure 4.28 Flexure stress-strain graph for the 7th fresh rib specimens.

Figure 4.29 Force-displacement graph showing how far the cross-head moved during the loading of the 5th fresh rib specimens.

Figure 4.30 Force-displacement graph showing how far the cross-head moved during loading of the 6th fresh rib specimens.

Figure 4.31 Force-displacement graph showing how far the cross-head moved during loading of the 7th fresh rib specimens.

Figure 4.32 Force-displacement graph showing how far the cross-head moved during loading of two dried rib specimens.

Figure 4.33 Force-displacement graph showing how far the cross-head moved during loading of the two frozen then thawed specimens.

Figure 4.34 Force-displacement graph showing how far the cross-head moved during loading of a fresh rib specimen.

Figure 4.35 SEM image of a fractures piglet rib during four-point bending. The fracture starts as a straight fracture (white arrow) and then progresses to a transverse oblique fracture (black arrow).

Figure 4.36 Fracture morphology of the fracture pattern seen in a frozen then thawed rib under four-point bending. The white arrow indicates the initiated straight fracture path, which terminates at the compressive surface (black arrow).

Figure 4.37 An example of how a fresh rib fractures under manual loading. The fracture appears to be a straight fracture.

Figure 4.38 SEM sequence from x12.4 to x80 magnification showing typical features of a dry bone fracture with a sharp fracture line along the tensile surface and a delaminated oblique fracture line on the compressive side.

Figure 4.39 Dried rib SEM sequence from x50 to x400 magnifications showing the the behaviour of fibe bundles during compressive failure. Cleaved bundles appear to buckle on the surface (open arrows) with inter-lamellar bridging at the fracture tip (closed arrows).

Figure 4.40 Dried rib SEM sequence from x80 to x1000 magnification illustrating the ragged compressive fracture surfacewhich shows irregular separation of fibre bundles each fracturing individually (open arrows), suggesting some fibre pull-out.

Figure 4.41 Dried rib SEM sequence from x25 magnification to x450 magnification showing the tensile fracture surface which illustrates clearly the roughness of separated and pulled-out fibre bundles.

Figure 4.42 Dried rib SEM sequence from x12.4 to x250 magnification showing the tensile fracture initiation parallell to the major. Here, there is precipitous surface fracturing with a smooth crack that shows none of the features of sub-surface pull-out and fracture seen in Figure 4.41.

Figure 4.43 Frozen and thawed rib SEM sequence showing the tensile surface from x12.4 to x1800 magnification.

Figure 4.44 Frozen and thawed rib SEM sequence from x100 to x800 magnification illustrating the smooth fracture plane which is characterised by numerous sub-surface micro-cracks, running parallel to the outer surface of the rib.

Figure 4.45 Frozen and thawed rib SEM sequence from x800 to x6400 magnification illustrating markedly different features to those of the dry specimen, with micro-cracks running parallel to the main fracture site. Pull-out fibre bundles are evident within the micro-cracks.

Figure 4.46 Frozen and thawed rib SEM sequence from x100 to x270 magnification showing the compressive zone which is similarly smooth, with no evidence of delamination or oblique fracturing.

Figure 4.47 Fresh rib SEM sequence from x50 to x300 magnification showing the fresh rib with the periosteum intact. There is evidence of periosteal damage on the tensile surface with extensive collagenous fibre pull-out resulting in a rough, irregular fracture surface. Individual collagen bundles are drawn out and separated prior to fracture (open arrows).

Figure 4.48 Fresh rib SEM sequence from x33 to x100 magnification. The periosteum is reflected here and there is evidence of smooth micro-damage on the tensile surface of the bone suggesting at least some surface failure of the bone.

Figure 4.49 Fresh rib SEM sequence from x100 to x700 magnification. At the higher magnification the micro-damage presents as an elliptical depression with noticeable fibre bundles (closed arrows).

Figure 4.50 The effect of bone type on strength. The dots represent the ratios between bones and the horizontal lines represent 95% confidence intervals as adjusted for by the Westfall method for multiple comparisons.

Figure 4.51 The effect of bone type on strain. The dots represent the ratios between bones and the horizontal lines represent 95% confidence intervals as adjusted for by the Westfall method for multiple comparisons.

Figure 4.52 The effect of bone type on modulus. The dots represent the ratios between bones and the horizontal lines represent 95% confidence intervals as adjusted for by the Westfall method for multiple comparisons.

Figure 4.53 The effect of bone type on maximum load. The dots represent the ratios between bones and the horizontal lines represent 95% confidence intervals as adjusted for by the Westfall method for multiple comparisons.

Figure 5.1. Type of fractures and how to describe their location on the ribs (taken from Galloway, 1999).

List of Tables

Table 1.1 Showing an example of studies in bone biomechanics that use freezing as a method of storage prior to testing.

Table 4.1 Table showing the raw data for the adult rib four-point bend test.

Table 4.2 Corrected strength and modulus values for the adult pig ribs.

Table 4.3 Measured 4-point bending results for the 5th dry rib specimens.

Table 4.4 Measured 4-point bending results for the 6th dry rib specimens.

Table 4.5 Measured 4-point bending results for the 7th dry rib specimens.

Table 4.6 Measured 4-point bending results for the 5th dry rib specimens.

Table 4.7 Corrected strength and modulus values for the 5th dried ribs.

Table 4.8 Measured 4-point bending results for the 6th dry rib specimens.

Table 4.9 Corrected strength and modulus values for the 6th dried ribs.

Table 4.10 Measured 4-point bending results for the 7th dry rib specimens.

Table 4.11 Corrected strength and modulus values for the 7th dried ribs.

Table 4.12 Measured 4-point bending results for the 5th frozen then thawed rib specimens.

Table 4.13 Measured 4-point bending results for the 6th frozen then thawed rib specimens.

Table 4.14 Measured 4-point bending results for the 7th frozen then thawed rib specimens.

Table 4.15 Measured 4-point bending results for the 5th frozen then thawed rib specimens.

Table 4.16 Corrected strength and modulus values for the 5th frozen then thawed ribs.

Table 4.17 Measured 4-point bending results for the 6th frozen then thawed rib specimens.

Table 4.18 Corrected strength and modulus values for the 6th frozen then thawed ribs.

Table 4.19 Measured 4-point bending results for the 7th frozen then thawed rib specimens.

Table 4.20 The corrected strength and modulus values for the 7th frozen then thawed ribs.

Table 4.21 Measured 4-point bending results for the 5th fresh rib specimens.

Table 4.22 Measured 4-point bending results for the 6th fresh rib specimens.

Table 4.23 Measured 4-point bending results for the 7th fresh rib specimens.

Table 4.24 Measured 4-point bending results for the 5th fresh rib specimens.

Table 4.25 The corrected strength and modulus values for the 5th fresh rib specimens.

Table 4.26 Measured 4-point bending results for the 6th fresh rib specimens.

Table 4.27 The corrected strength and modulus values for the 6th fresh ribs.

Table 4.28 Measured 4-point bending results for the 7th fresh rib specimens.

Table 4.29 The corrected strength and modulus values for the 7th fresh rib specimens.

Table 4.30 Measured 3-point bending results for two dried rib specimens.

Table 4.31 Corrected strength and modulus values for two dried rib specimens.

Table 4.32 Measured 3-point bending results for two frozen then thawed rib specimens.

Table 4.33 Corrected strength and modulus values for two frozen then thawed rib specimens.

Table 4.34 Measured 3-point bending results for a fresh rib specimen.

Table 4.35 Corrected strength and modulus values for a fresh rib.