



**Full Length Research Article**

**TISSUE SCURVY MISDIAGNOSED AS CHILD ABUSE**

**\*Michael D. Innis**

Retired Haematologist Princess Alexandra Hospital, Brisbane, Australia

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**ABSTRACT**

**Background:** It is postulated that Tissue Scurvy is a disorder in a genetically susceptible child in whom the cellular uptake of Vitamin C is inhibited following pancreatic  $\beta$  cell destruction causing Insulin deficiency. Insulin is required for the transfer of Vitamin C and Glucose into the cell for efficient cellular function. Failure of this process causes Tissue Scurvy which is mistaken for Non-accidental Injury (Shaken Baby Syndrome) with serious consequences for the care giver.

**Method:** A child presenting with the signs and symptoms suggestive of Non-accidental injuries was investigated for evidence of insulin deficiency and Liver dysfunction.

**Result:** It was found that there was evidence of hyperglycaemia, implying insulin deficiency, and Liver dysfunction, as shown by abnormal liver function tests. Liver dysfunction implies defective -carboxylation of the Coagulation Factors II, VII, IX and X and the bone forming proteins Osteocalcin and matrix Gla Protein thus predisposing to spontaneous bleeding and fractures.

**Conclusion:** Tissue Scurvy is an autoimmune disorder in a genetically susceptible child resulting from destruction of the  $\beta$  cells of the Pancreas which causes insulin deficiency and failure of the cellular uptake of Vitamin C and Glucose. Hyperglycaemia and Liver dysfunction are constant biochemical findings and bleeding and fractures common and can be mistaken for child abuse. Viral, bacterial and parasitic infections may initiate the process.

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**INTRODUCTION**

Vitamin C maintains the integrity of the vascular endothelium, increases the synthesis and deposition of type IV collagen in the basement membrane, stimulates endothelial proliferation, inhibits apoptosis, scavenges radical species and may play a role in preventing endothelial dysfunction (May and Harrison, 2013). Cunningham *et al.* (1981) demonstrated reduced mononuclear leucocyte ascorbic acid (Vitamin C) content in adults with insulin dependent diabetes mellitus consuming adequate dietary Vitamin C and this is the essential path physiology of Tissue Scurvy when applied to all cells – not only mononuclear leucocytes, Normally insulin binds to its receptor on the cell surface and initiates a chain of events that leads to the insertion in the plasma membrane of a transmembrane glucose transporter called GLUT 4 which facilitates the transport of glucose and other nutrients into the cell. It is the failure of this process which prevents the entry of Vitamin C into the cell and causes “tissue scurvy” which

affects every cell in the body to a greater or lesser degree (Cunningham, 1998). Tissue scurvy, when it involves the function of the cells of the liver leads to under carboxylation of the coagulation factors II, VII, IX and X and of osteocalcin and matrix Gla protein resulting in bruises, hemorrhages and fractures (Vermeer *et al.*, 1998).

**Case Report**

A three year old boy was brought to the hospital Emergency Department by his mother with the complaint that he was not “breathing right.” The child had been left in the care of the mother’s “boyfriend”. The child was being punished and given “time out” by being made to stand in the corner for some minor dispute with his siblings. While there he suddenly collapsed, fell to the ground and stopped breathing. The carer immediately commenced CPR with marginal success in that the child started breathing spontaneously but irregularly and became limp and unresponsive. The mother was called and together they went to the hospital where the attending doctor noted the child was grey, limp, unconscious and unresponsive, hemiparetic with “ecchymosis from head to toe” and “declared a Trauma, Level 1.” It was also noted that “his hands were swollen into balls as if they had been crushed” and

**\*Corresponding author: Michael D. Innis**  
Retired Haematologist Princess Alexandra Hospital, Brisbane,  
Australia

the feet had round reddened areas. Further examination, according to the admitting doctor, showed “multiple bruises on the abdomen, back, face, legs? bite marks, ?ligature marks around neck” and the bruises were of “varying ages”. Some of the bruises had a central pallor and some “resembled cigarette burns”. A Consultant Paediatrician noted 1. Lichenified rash on neck 2. Laceration left side forehead 3. Bruises on both sides of the face 4. Laceration right cheek. 5. Purple spots on the chest. 6. Linear bruises on the left shoulder 7. Eschars both arms and back and right side of the abdomen. 8. Finger tip marks on the right arm 9. Scattered bruises on both legs 10. Red marks on the scrotum 11. Red mark on the left hip 12. Swelling of both hands and arms.



No explanation could be offered for the bruises by the mother or boyfriend other than the child bruised easily and was continually falling off his bicycle, having refused to use “trainer wheels”. Furthermore his older siblings play rough and “kick him in the groin” sometimes. His mother had noticed the swelling of the hands some days earlier and the boyfriend, thinking the child had developed a rash on his neck, applied some cream. Dried “cracked lips” also were noted and cream applied. The child had been vomiting recently and complained of a headache for which he was given Tylenol.



“There was blood around the bowel and in the retrosternal space”. Significant Laboratory Investigations on admission were:



#### Evidence of autoimmune cell dysfunction

- Glucose 141 mg/dL NR 60 – 115 mg/dL
- ALT 177 U/L NR 7 – 90 U/L
- AST 187 U/L NR 5 – 60 U/L
- GGPT 91 U/L NR 8 – 78 U/L
- Albumin 2.8 g/L NR 3.4 – 5.1 g/L

#### Evidence of Acidosis

Blood pH 7.29 NR 7.32 – 7.42

#### Evidence of Anaemia

- Hct 32.6 NR 34 – 40 %
- Hgb 10.9 NR 11.5 – 13.5 g/dl

#### Evidence of a coagulation disorder

- Prothrombin Time 11.7 secs NR 10.1 – 11.5
- Partial Thromboplastin Time 23 secs NR 26 – 38

## DISCUSSION

Evidence of Tissue Scurvy Non-purulent conjunctivitis. Non-exudative bulbar conjunctival injection Oropharyngeal changes (injected pharynx, strawberry tongue, fissured lips) Polymorphous skin lesions Extremity changes (erythema of palms and soles, oedema of the hands and feet, periungual desquamation). In addition elevation of liver enzyme values, usually two to threefold is common Atypical Tissue Scurvy presents with some of these features, not necessarily appearing at the same time. In this child the polymorphous skin lesions (described, erroneously, as bites, cigarette burns, finger marks, eschars and strangulation marks), marked oedema of the hands and arms, erythema of the feet, fissured lips, vomiting and a two-fold elevation of liver enzymes leaves little doubt regarding the diagnosis.

A low blood pH, such as one finds here, is indicative of a change in the metabolism of the body resulting from the non-availability of oxygen as seen in either cardiac or respiratory arrest. This result supports and is entirely consistent with the history given by the carer that the child suddenly stopped breathing went grey and limp and suffered what is an Apparent Life Threatening Event (ALTE). The alacrity with which the admitting doctor declared “Trauma Level 1” coloured subsequent clinical and investigative procedures. However the presence of hyperglycaemia is clear evidence of Insulin deficiency provoking the onset of Tissue Scurvy.

## Conclusion

A prominent role of vitamin C in maintaining the integrity of the vascular system is clearly dysfunctional in this child. Vitamin C is required for the synthesis of collagen, the intercellular "cement" substance which gives structure to muscles, vascular tissues, bones, tendons and ligaments. In addition, vitamin C contributes to preventing haemorrhaging and bleeding. It also improves the absorption of iron from the diet and helps prevent anaemia seen in this child. Another important function of Vitamin C is its role in immunity where it functions as an anti-allergic agent since it is a natural antihistamine. It both prevents histamine release and increases the detoxification of histamine. It is the failure of this anti-allergic function which initiates all the features of Tissue Scurvy establishing it as an Autoimmune Disorder

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