



Multiple Keratoacanthoma: a within-subject longitudinal study: Chainsaws, bar and engine oils, wood chip and dust effluent, puncture wounds, green-ant bites, mosquito bites, saps, physical stress, psychological stress and happiness, nutrition, and relevance to the developing world

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ABSTRACT

A 60–61-year-old male with no previous history of keratoacanthoma acquired a two-hectare block of regrowth forest (natives and feral pine trees, of 30-plus years growing) in the wet tropics of coastal north-eastern Australia, at the beginning of 2022, and proceeded with its development into mostly an integration of mixed tropical fruit trees amongst native trees, on into later 2023 ongoing. Chainsaw chip effluent, containing chainsaw bar/chain oil was deposited directly onto bare skin including that of the lower legs, particularly the right lower leg, and its removal substantially delayed and ineffectively carried out. In 2022, 10 keratoacanthoma arose in the right lower leg, and 2 in the left lower leg. In 2023, he substantially reduced the deposition of chainsaw chip effluent onto bare skin, particularly the right lower leg. In 2023, 1 keratoacanthoma arose in the right lower leg, and 2 in the left lower leg. A Chi squared test of these data gave $p = .08$, statistically significant at the $p < 0.1$ level applicable to this sort of small-number exploratory study. Other factors that were probably or possibly involved in interaction with the deposition of chainsaw cutting effluent were: daily puncturing/scratching of the skin, daily green tree ant bites, daily mosquito bites, deposition of tree saps onto the skin, and low vitamin B12/ raised homocysteine, and a possible protective effect from combined high levels of beta-carotene, vitamin C and vitamin E from food sources. Physical or psychological stress or state seem unlikely to be contributory causes in this case. The case has potentially substantial relevance to the developing world, where clothing and personal protective equipment is relatively insubstantial, and oil discarded from internal combustion engines is frequently used as chainsaw bar/chain oil.

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INTRODUCTION

Background

Keratoacanthoma

Keratoacanthoma (KA) is a dome-shaped dermal tumour (classically epidermal) with a relatively depressed keratinous necrotic centre or plug, fast-growing in early growth stages, usually regressing after 1-2 cm diameter is reached, often not clinically well distinguishable from some squamous cell carcinoma (SCC), but fairly well distinguishable by further laboratory tests.¹ Multiple keratoacanthoma has been stated to be rare.² Multiple keratoacanthoma associations include with some genetic conditions for, or predisposing for, some less common types of cancer, for example Muir-Torre syndrome (sebaceous neoplasia and visceral malignancy), xeroderma pigmentosum (high sensitivity to sunlight, premature skin aging, and proneness to skin cancer), Ferguson-Smith disease (Multiple Self-healing Squamous Epitheliomas (MSSE)), and Witten-Zac syndrome (early childhood, small miliary plus larger lesions, morphologically resembling Grzybowski plus Ferguson-Smith), and Grzybowski syndrome is generalised eruptive keratoacanthoma, involving hundreds to thousands of small keratoacanthoma.^{3, 4, 5} Solitary keratoacanthoma have been found to not be associated with concurrent or subsequent internal malignant neoplasms.⁶ Aetiology of keratoacanthoma in general include: exposure to UV radiation (as in sunlight), male sex, older age, fair skin, smoking and alcohol consumption.² Immunosuppression has also been noted as predisposing.⁷ Previous tissue trauma, likewise.⁸ Exposure to machine oils, as in industrial contexts, has also been reported to be associated with keratoacanthoma (polyaromatic hydrocarbons as from acid treatments now phased out have been suggested as the more causal agent)⁹, as has the use of some pharmacotherapies (e.g. BRAF inhibitors).¹⁰

Sullivan (1997) cites Belisario's 1959 book *Cancer of the Skin* as noting personal experience of 50 cases/y in practice, in which KA/SCC ratios were 1/12 in Melbourne, 1/5 in Sydney and 1/(1 to 1/2) in North Queensland (all in Australia), so increasing with proximity to the equator.⁷ A major epidemiological study in the state of Queensland, the QSkin Sun and Health study, found KA very predominantly on the lower legs, noting that this contrasted substantially

with body sites noted elsewhere in the literature.² Keratoacanthoma has been much disputed up till the present, with regard to whether it is a precancerous or incipiently cancerous lesion, a precursor of squamous cell carcinoma with an ability to metastasize, or, on the contrary, a non-cancerous benign lesion with a benign resolution in natural history.^{2, 6, 7} As a corollary to both convictions, and to agnosticisms, of its being precancerous, the most common treatment up to the present has been surgical removal of lesions fitting the gross keratoacanthoma physical appearance to the naked eye, with subsequent cell/tissue characterisation in the pathology lab.^{1, 2, 4, 6} Other treatments include: radiation; topical 5-fluorouracil or imiquimod; intralesional 5-fluorouracil, methotrexate, bleomycin, interferon- α 2A and 2B or corticosteroids; systemic retinoids (e.g. isotretinoin, etretinate or acitretin), often in combination with the foregoing pharmaceuticals; electrodesiccation and curettage; and laser ablation w/wo a topical agent such as 5-fluorouracil.^{3, 4} Alternatively, observation of correctly diagnosed KA, with the expectation of satisfactory natural resolution, has been proposed.⁷

Laboratory Investigations as to whether keratoacanthoma is a pre-cancer of squamous cell carcinoma, or a benign lesion well differentiated from that, have included tumour architecture⁷, volume-weighted mean nuclear volume¹¹, imaging studies¹², and various histopathological studies.¹³ Despite varied success and clinical usefulness of findings among these, the net meaning of these studies seems to support KA being substantially different and differentiable from SCC, such that these be different biological entities with different clinical outcomes. A 2013 systematic review of KA cases reported in the literature found 445 cases of KA with reported follow-up in 113 published articles, none of these cases resulting in death or distant metastases, whereas 429 cases of SCC of the skin, resulted in 61 cases of metastases and 24 deaths as a direct result of SCC.¹⁴ However, publication bias seems likely, to however small an extent, as it seems unlikely that absolutely no misdiagnosis ever occurs(ed). Misdiagnosis and its consequences are a/the major concern.¹⁵⁻¹⁷ Nevertheless, all things here noted considered, it does seem that keratoacanthoma, *correctly*

diagnosed, is highly enough probable, with regard to treatment by observation being rightly enough chosen over excision, to be a benign, non-cancerous lesion with a natural history of resolution, and with scars from that generally being no more disfiguring than scars from surgical excision.⁷

Beta-carotene, Vitamin C, Vitamin E and Free Radicals

Beta-carotene (and other substantially non-equivalent dietary carotenoids), vitamin C and vitamin E, have each been said to have a well-documented role in skin health, and this possibly more so in interaction (forming a biochemical chain for holding the lone electrons of, and definitive of, free radicals, such as to minimise damage from them until they can be further dealt with), but the dietary-contextual complexity of this, including negative effects in some isolated supplementary contexts, in some dietary contexts, renders substantial exposition of this topic beyond the scope of this work, and so the potential relevance is merely noted here, and the case's general dietary features relative to this given below.

Psychological Stress and Immune Function

There is now a general consensus that excessive psychological stress and unhappiness can negatively affect immune function, of particular potential interest here, that chronic psychological stress is associated with suppression of both cellular and humoral immunity.¹⁸ There is now also a general consensus that immune function is a factor in the course of carcinogenesis and cancer progression¹⁹, and this seems likely to apply also to keratoacanthoma as to various other skin diseases.²⁰

Chainsaws, Oils, Deleterious Molecules, Cutting and Chip Effluent

Chainsaws up till very near the present have been mostly petrol (nearly all two-stroke, using petrol with engine-lubricating oil pre-mixed), with corded electric chainsaws up to lower-middle power ranges making steady inroads into domestic use in the developed world for more than the last decade, and cordless battery-powered chainsaws becoming increasingly mainstream for smaller chainsaws including for professional use in recent years up to the present. All chainsaws, petrol, corded or cordless, use bar oil to lubricate both the travel of the cutting chain

over the chainsaw bar, and the cutting of the wood by the cutting chain. Chainsaw bar oil in common use includes proprietary oils marketed expressly as chainsaw bar oil, and, even very common in the developed world, fresh low-priced mineral car engine oil, and used car engine oil. Such mineral oils are derived from conventional oil refining processes, and are a mixture of straight-chain and branched hydrocarbons, C-C bonded cyclic hydrocarbons, shared (resonating) C=C-C bonded benzene cyclic derivatives, and polycyclic derivatives of both these (multi)circular hydrocarbon structures with possible substitutions by nitrogen, sulphur, chlorine, other CH moieties, other atoms and molecules and combinations of these, and the effluent from the use of these oils in chainsaws as bar/chain oil (use often including subjecting these molecules to high temperatures, and in the presence of oxygen, with deleterious molecular outcomes) is considered sufficiently harmful to human health and to the environmental ecology to warrant concern, as in, just for one example, about polycyclic aromatic hydrocarbons (PAH).²¹ Use of vegetable oils instead, in substantially many contexts, is said to result in substantially less toxic effluent.²¹ Chainsaw chip cutting effluent should ideally be larger chips mostly immediately visible as such with the naked eye, but with deteriorating cutting chain sharpness, and suboptimal height of the rakers that determine the depth of the cut that the horizontal cutting edges make (there is also a vertical cutting edge on each chain tooth, that acts to mostly trim wood left protruding into the space left by the travel into the cut by the horizontal cutting edges that are doing the very large majority of the work), there is not only a change in chip cutting effluent to include, or even become mostly composed of, smaller particles, including powder, but this effluent will have a higher proportion of bar/chain lubricating oil in it, because there will have been more revolutions of the cutting chain required to make the cut, than with optimum chain sharpness and raker height, as the feed of bar oil onto the bar is determined by the number of revolutions of the chain around the bar, not by how much wood is cut. There is almost certainly here some analogy with the smaller particles in other air pollutions being more detrimental to health because they will have more penetration and be less easily removed (e.g. from the lungs), as classically the case with automotive exhaust effluent.^{22, 23} With loss of

cutting chain sharpness there is also an increase in the heat being generated by the cutting, up to and including the point where the contacted wood is being burnt as evidenced by smoke being produced and burnt wood remaining, which very probably includes the point where undesirable molecules that result from the heating/burning of oils are substantially increased (above already raised levels in used automotive oil) relative to potential to adversely affect health outcomes. There has only been a small number of studies focused on chainsaw effluent in regard to health, and they generally have not addressed this level of detail.²⁴⁻²⁹

Chainsaw Use, Bar/Chain Oil, Personal Protective Equipment and Clothing, and Agricultural Injuries and Biological Hazards in the Developing World. There is substantial and increasing use of chainsaws in the developing world, in both farming and timber activities, much of it clandestine, poorly regulated or effectively unregulatable, often increasing in response to financial hardship by way of acquiring saleable timber.^{30, 31} Oil used as chainsaw bar/chain oil in the developing world has much (probably the majority of it is) used (discarded) internal combustion engine oil (e.g. from motor vehicles) amongst it (therefore already including heat-modified molecules, before use as bar/chain oil).³² Such oil use is fairly common even in the developed world. Inhalation of chainsaw bar/chain oil effluent seems potentially roughly as serious a health concern as inhalation of chainsaw internal combustion engine effluent, but the literature seems virtually devoid of any address of this aspect, let alone the consequences of dermal deposition of it. Long work clothing (other than in cold weather and in some cultural contexts) and personal protective equipment as commonly standard in the developed world, are far from being in optimal or even general use in rural and agricultural contexts in the developing world.³³ A study of agricultural workers in the Mysuru district in India found that most subjects had cuts, lacerations or puncture wounds at least once in the foregoing year.³³ Relatedly, it seems that there is some workplace culture in such contexts that regards risk as substantially inherent, such that even when relevant education is implemented, the uptake of its suggestions for behaviour modification is far from complete.³⁴ The number of potentially biomedically significant biological agents that an agricultural

worker might possibly encounter, particularly in interaction with some other factor(s) (e.g. UV exposure, tissue trauma and chainsaw effluents) almost certainly exceeds hundreds, most being undocumented, and here are referenced just a random couple from the small number that have been documented, regarding an insect (processionary moth) and a plant (agave).^{35, 36}

Methodology

The statistical significance of differences in the number of keratoacanthoma on the left and right lower legs, respectively, in years 2022 and 2023, respectively, was assessed by chi squared test. Other possible contributory factors, without data able to be tested statistically, are: deposition of chainsaw chip effluent on skin, daily puncturing/scratching of the skin, daily green tree ant bites, daily mosquito bites, deposition of tree saps onto the skin, physical activity stress, psychological stress and happiness, low vitamin B12/ raised homocysteine, high beta-carotene, vitamin C and vitamin E, and family history of cancer, and these were enumerated and considered as possible contributory factors to the keratoacanthomas.

The case:

A 60–61-year-old male with no previous history of keratoacanthoma acquired a two-hectare block of regrowth forest (natives and feral pine trees, of 30-plus years growing) in the wet tropics of coastal north-eastern Australia, at the beginning of 2022, and embarked on developing mostly one hectare of it into mostly an integration of mixed tropical fruit trees amongst native trees. Planting started in found clearer areas, and selective clearing of native trees and feral *Pinus caribaea* pine trees (Caribbean pine), and vines, proceeded with nearly daily intermittent use of chainsaws, in the context of the absence of any long clothing (“butt-naked but for thongs on feet”, he noted), mostly in some degree of shade, although infrequent overexposure to sunlight, mostly of the upper body, did occur. Chainsaw effluent chips and dust had frequent contact with legs (mostly the right side) and also arms and body (mostly the right side), and any deposits other than very obvious ones of larger particles were generally allowed to remain until the next bathing, almost always being with just water and no soap. Frequently the saw chains were not kept optimally sharp, resulting, as chains became less

sharp, in more bar oil being consumed per unit of cut volume and this being output on smaller wood chips and greater proportion of wood effluent particles being so small as to be more accurately termed dust/powder than chips. Various saps were frequently deposited (other than from chainsaw cutting effluent) on the skin, and skin (mostly of the lower legs) was scratched, cut or punctured with nearly daily frequency, especially by vines bearing sharp spikes along their length. Initially a keratoacanthoma, perhaps aggravated in its development by frequent picking-at, was removed from the outer right upper arm in October of 2022, and identified in pathology investigation. Already having started by this time, and over the next couple of months, a dozen or so keratoacanthomas of varying sizes evolved on the right lower leg, and a couple on the left lower leg. In his reviewing of the literature, the case eventually discovered that machine oils were probably causally associated with keratoacanthoma. Thereafter he avoided having the main stream of chainsaw chip effluent from cutting being immediately deposited on his body, although this was less feasible when felling larger trees with a larger chainsaw (e.g., Stihl MS460) with the usual horizontal and angled cuts required for felling, and in some other cuts used in getting hung-up felled trees down to earth in a piecemeal manner. By about a year of ownership and working on the nascent farm, the frequency of the lower legs being scratched, cut or punctured by spiky vines had decreased to very roughly a tenth or less of what it had been at the most intensive of the clearing, but in nearly every week there was/is some new wound(s) to the lower legs from something or other. He carried out long-distance running throughout, on two or three mornings of the week, increasing in mid-winter preparatory to participating in the nearby local yearly road marathon in both 2022 and 2023, followed some weeks later by the trail marathon in both 2022 and 2023, the training runs being mostly in shade but with the front of the body not in shade for 1.6 km, and the right side of the body not in shade for the 2.4 km at the finish of the runs. The total training load for the running was greater in 2023, the same three training runs (24 + 24 + 30 km) per week being started a month or so earlier, increasing the usual lesser habitual long-distance running of decades standing. He attributes the slower marathon time in 2022 (4:05 vs 3:44 in 2023) to be due to unwitting self-handicapping by frequent breaking of branches

across the right quadriceps just above the patella, prior to the road marathon, and the slower trail marathon time in 2022 (5:01 vs 4:51 in 2023) to be similarly due also to a glancing impact likewise across the right quadriceps just above the patella, of a leaning tree trunk (diameter approximately 150 mm) that had 'barber-chaired' in felling, being sprung into the air by the 1 m remaining attached to the stump, before accelerating downwards unimpeded to strike first the lower right arm (novice's mistake, though sometimes rendering fatality even in professional fellers), with subjectively great force (though not breaking or fracturing the arm bones). Several weeks before the road marathon, his right leg had fully collapsed to the bitumen just after "switching off" purposeful effort to cruise the last few kms home of a run, and, during the first run after the barber-chair, as he similarly "switched off" purposeful effort to run easily back down the long gradual incline he was running a set of repeats of, the right leg started to collapse in the same manner as in the previous incident, but being now reflex-conditioned, he focused to stop the collapse, and stopped to find the small scab and the bruising underneath, that he had not noticed (was 'blind' to, in the experimental sense) at all till then, as the arm, rather, was much the focus of attention. Thus, the etiology of both the initial leg collapse, and the subsequent first stage of leg collapse, were clarified. The relevance of this matter to the present context is that he considers the total physical demands, of farm work plus training for the marathons, in 2022 and 2023 respectively, to have been not much different, despite the differences in marathon finishing times, as in 2022 there had been slightly greater physical demands from the farm work than in 2023, in 2022 there having been a greater sense of urgency to try to get progress on the farm to a certain point by the end of that year, whereas in 2023, although the target goals there had increased by then, there was as much a sense of resignation as of urgency, so slightly less work balanced by slightly more running.

His family cancer history includes: gut cancer in maternal grandfather, lung primary and liver secondary cancer in father, breast cancer in mother, gut cancer in paternal uncle, a non-bone cancer in the leg of a different paternal uncle, skin cancers or keratoacanthomas (all excised) in his medicated schizophrenic brother's right arm, and his own late-

onset (later 40's) nonseminomatous testicular cancer. Regarding psychological stress throughout, in the latter half of 2021 his mother died, he having returned from overseas work at the start of the year and remained in Australia at the family home to care for her, where she lived with the other son, a sufferer of schizophrenia. He was and is satisfied that he was where he should have been, and doing what he should have been doing, but there was substantial stress and unhappiness in a peak during his mother's dying in hospital, centred around insufficient use of the benzodiazepine tranquilizers and some other drugs resulting in his mother being serially tortured by restless legs in the context of being virtually too far mentally deteriorated for any satisfactory interpersonal interactions to be any longer available to her, or, for the net value of all such periods of consciousness being virtually certain to be a negative, not a positive, and this unhappiness and some stress carried forward in his writing up the issues and taking the hospital to task, and in the matter of his sister, quite generally negligent including at some crucial junctures in the year before the death, psychologically rationalising this negligence of hers, including by projecting blame to others, in having reported to hospital staff that she doubted that the family home was a suitable place for their mother to be, due to his "coercive control, lack of empathy, emotional distancing, etc" (glimpsed on hospital records screen by him). After the mother's death, he had issues to deal with regarding the sister, who he characterises also as being in denial of her own laziness in her underachievement relative to straight-A achievement into but not finishing high school, manifest in exaggerated focus on the patriarchal glass ceiling and other aspects of patriarchy (the case maintains that he is much a feminist in thought and deed), and her being the Trustee and Executor of the Will, and her denial of his efforts in ceasing his own gainful employments overseas a decade earlier to spend most of a year in fairly extensive renovations of the previous family home so that it could be sold at some decent price, to the substantial ultimate benefit of the rest of the family, and the likelihood of her exercising (or attempting to) gratuitous power over him going into the future, requiring the generation by the end of 2021 of 35 written pages detailing the relevant matters such as to be a complete legal statement of case if that should become necessary, and an input to her own mentation and that of the

estranged progeny of hers (estranged from him, of their choice, shortly following the death of the father in 2006 from cancer, in which he (the case) was again the principal carer, again dropping gainful employment overseas on the belated diagnosis being made, they, he maintains, being wrongfully influenced by her and her husband of the time), after the delivery of which write-up, most of the stress from this source was lifted, though there was for about another year (2022) ongoing unpleasant communications made necessary in order to lay out piecemeal to his sister what actions and/or future such (in)actions by her would (not) be tolerated, i.e. what the limits of her power were/are, and what her obligations were, as he saw it, at the end of which he considers this unpleasant process to be hopefully virtually finished, and sees very little stress or unhappiness pending for the future in this regard.

Stress on the nascent farm, not considered to include the meeting of the physical demands of virtually self-supported pioneer farming (but including chainsaws rather than axes, and on a smaller scale, and not of absolutely existential consequences), reached some peak in later 2022 as the dry season progressed and eventually wallabies started damaging the young fruit trees, leading to him conceiving the method of building on the ground around each fruit tree a circular perimeter of roughly 3-4 m diameter, of logs of felled (mostly) tree trunks, each filled in with a deliberately somewhat jumbled rather than very well flattened mixture of green and brown plant waste, such that wallabies, with their relatively big feet (hence macropods) are deterred from entering these perimeters due to the likelihood of tangling of the feet amongst the jumbled green and brown waste. He was ultimately happy with this outcome, but in the initial stages of implementing it, it constituted substantial additional stress, as it constituted a considerable additional expenditure of time and energy over what he had initially envisaged as the end point of a stage of development there (roughly one year full time) after which he would be relatively much freer to carry on the completion, furthering and starting of various works of health science research and writing (he has a substantial background in health sciences), the ongoing delay of which was beginning to become an underlying constant source of some dissatisfaction, unhappiness and stress, this delay having commenced with his return to China after the

first year of teaching middle and high school maths and science there, as the remuneration seemed sufficiently attractive to warrant the extension of delay, for what became a continuous total of 3.5 years, followed by his mother's dying about 3/4 of a year after that, and his care of her at her home, followed by, some months after the death, the mostly chance encounter with the opportunity to purchase the 5-acre of regrowth forest of very favourable soil and terrain characteristics, and develop it into a little integrated tropical fruit tree/ native tree/plant eco-farm, something of the sort of activity that had been in mind, but for some more future point in time, the opportunity being seen as one not readily substitutable in value at whatever point in the future, such as to warrant further delay of his scientific work for yet another year. Around about the time the wallaby barriers had been nearly completed as an initial response, feral pigs began making incursions which included some damage to wallaby barriers, and response was made to this by insufficiently-successful attempts to locate and chase them out, and the further piling-on of larger pieces of wood in the wallaby barriers, the pig damage eventually becoming minimal and more in undeveloped areas of the property.

On the issue of irrigation, it was initially envisaged to not have any at all, on the bases of there being many trees and plants of various types, including mangoes and litchees, apparently surviving and bearing fruit well enough in the general local area, there being already good leaf litter generally on the ground throughout the property, and the ultimate plan being to have a virtually contiguous canopy, and for there to be sufficient use of mulch on ground around trees, to protect against soil drying out and to nourish the trees. Then by 2022 he had decided to install a full irrigation system to add safety and optimality. Then after the 2022-2023 wet season, including on the basis of soil moisture findings on hand-augering down to roughly 1.5 m in the planting of each new seedling, he reverted to deciding not to have an irrigation system at all. In later 2023 he was inclined towards having a partial irrigation system, with bore pump, holding tank, and poly-pipe mains running to several main nodes where a hose would be attached and used to deliver water by hand as thought suitable for each plant individually. The psychological stress here is that involved in trying to keep expenditure of mainly time down to the minimum required to have

the very large majority of the fruit trees kept in good enough health to bear sufficient (as against maximal) crops, and in the context of his not being there for protracted periods in the future, and some level of gamble and risk in what is essentially a titration experiment of lowest water application allowing survival to enough maturity (i.e. of (e.g., tap) root development) until either probable on-going survival with sufficient fruit-bearing without irrigation at all seems achievable, or, on the other hand, that irrigation system is established, preferably with only the minimum financial expenditure (the how of this latter aspect being not yet clear enough).

On the issue of financial concerns, he has a fairly frugal existence regards accommodation (basic mobile home conversions of smaller vehicles) and food, now of habitual and comfortable long-standing (but has some collections of things well outside the necessities of survival), and enough money in fungible assets, that he does not consider any substantial stress or unhappiness attends this aspect. Considering these psychological aspects taken together overall for respectively 2022 and 2023, he considers that any degree of positivity or negativity, such as might affect immune function and other biochemistry, to have been approximately equal overall, though by the stage of considering these aspects, he was no longer blinded to the differences in keratoacanthoma outcomes in these years.

Diet

His diet was of more than 3 decades standing: virtually raw vegan; two meals per day, brunch and dinner, eaten in very similar and consistent order of constituents: leafy greens to first pack dental spaces with neutral-pH-no-carbohydrate material, then proteinaceous foods (nuts, legumes, seeds, cereal and other grains) some of which eaten with root vegetables and/or more leafy greens, then fruit, then leafy greens. Infrequently, some dried fruit is eaten with a proteinaceous food (nuts) or later with the fresh fruit. The only exception being one medium-sized green-nymph-stage grasshopper eaten whole, fresh and raw in late 2022. Vitamin B12 supplementation (oral capsule) had been begun a decade and a half ago, as a precaution against thrombosis (via raised homocysteine level) from then-immediately-pending orchietomy for



nonseminomatous testicular cancer, but lapsed for 4 or 5 years up to the present. Accordingly, his vitamin B12 level must be substantially lower than the normal range (160-150 pg/ml) and his homocysteine level substantially higher than the normal range (<15mM).

On the other hand, his intake of beta-carotene, vitamin C and vitamin E, from this food, would all very probably be well above the general population average intake from food (his skin has the orange hue of carotenemia).

Table 1 Case’s Keratoacanthomas by leg and year, and factor data by year

Period	2022	2023
Growing, peaking or indolent (i.e. not mostly well resolved and resolving) Keratoacanthoma (R leg)	n = 10	n = 1
Growing, peaking or indolent (i.e. not mostly well resolved and resolving Keratoacanthoma (L leg)	n = 2	n = 2
Chainsaw Chain Effluent Exposure (R leg) (nearly all main streams are positionally avoidable)	10 relative units	<1
Chainsaw Chain Effluent Exposure (L leg) (main streams are not positionally avoidable when horizontally cutting into larger trees in felling)	3	2
Promptness of washing off chain effluent with soap	nil, soap not used, water used at end of shift as in for removing sweat and soluble dirt	Soap used with delays of up to 1 hour, more delay for lesser perceived contact with effluent
Clothing and other protective equipment	Nil other than thongs on feet	Nil other than thongs on feet
Leg Puncture Wounds (per day)	3	1
Green Tree Ant (<i>Oecophylla smaragdina</i>) Bites (per day)	Dozens	1 or 2
Mosquito Bites (per day)	Dozens	1 or 2
March Fly bites (per day)	1 or 2	0 (mostly) or 1 (rarely)
Type of Sap in chainsaw chain effluent	Roughly equal pine vs non-pine	Mostly pine
Type of Sap in non-chain-effluent Deposition on Skin	Roughly equal pine vs non-pine	Mostly pine
Exposure to Sunlight	Less, due to farm work being in more shade	More, due to farm work being in less shade
Diet: of decades standing: raw vegan; two meals per day, eaten in very similar and consistent order of constituents	Virtually the same	Virtually the same
Blood B12 level (normal >150, replete >380 pmol/L)	74 pmol/L	Therefore <74 pmol/L
Blood Active B12 level (normal > 35 pmol/L)	<5 pmol/L	Therefore <<5 pmol/L

Blood Homocysteine level (normal <15 umol/L)	33 umol/L	Therefore > 33 umol/L
Blood cell parameters all well within normal, other than Red Cell Count 4.2, bottom of normal range (4.2 – 6.6 × 10 ¹² /L) and Mean Red Cell Volume (MCV), 98 fL at top of normal range (80 – 100 fL) (consistent with macrocytic anaemia of low B12)	Red Cell Count: 4.2 × 10 ¹² /L MCV: 98 fL	Therefore (assumed) ≤ 4.2 × 10 ¹² /L Therefore (assumed) ≥ 98 fL
Self-Perceived Overall Psychological State of Health ^a	7.5	7.5
Self-Perceived Overall Physical State of Health ^b	9	9
Vaccinations for Covid 19 (symptomless))	2 of, 2021	2 of, 2021
Self-handicapping of running performance	Trauma to lower quadriceps	No trauma to lower quadriceps
Road marathon finishing time	4:05	3:44
Trail marathon finishing time	5:01	4:51

^a Self-Perceived Overall Psychological State of Health incorporated 'locus of control', 'self-efficacy', total luck in life, luck in the general present, successful and timely farm development progress, delay of scientific work progress and other career progress, intellectual development, financial state, physical health, social interactions, distance running training load and competition outcomes, displacement of saxophone and martial arts practice by farming work, Dupuytren's Contracture and other overuse injuries to hands, view of the future. (scale from 0 bad, to 10 good)

^b Self-Perceived Overall Physical State of Health, incorporated cardiovascular and other organ system health, wound healing, diet, fairly well rehabilitated lumbar intervertebral disk rupture and left hamstring damage of initiation four decades ago, Dupuytren's Contracture (operated on in the right, not yet in the left) and other (overuse) injuries to hands (weakened and stiff index fingers, the left recovering latterly, the right less so, apparently due to excessive hand secateur use earlier in the clearing and green-waste-processing, ability to carry out farm work and distance running as required. (scale from 0 bad, to 10 good, adjusted for age).

Statistical Analysis

The data constitutes a within-subject repeated measures (longitudinal) study, and was appropriate for analysis by Chi-squared test, depicted as follows:

	2022	2023
Right Leg	10	1
Left Leg	2	2

The result by online Chi-Squared tester(s) is $p = .08$

DISCUSSION:

Firstly, $p = .08$ would be statistically significant at $p < 0.1$, whereas it would not be statistically significant at $p < 0.05$. Note that for this sort of low-number, initial, exploratory, low-immediate-consequence study, selecting a $p < 0.1$ significance level is generally considered quite valid, and here the data is very simple and easily laid out for very ready

interpretation. Furthermore, the value for the right leg in 2023 should really be 0, not 1, as all keratoacanthomas there were either well resolved or well resolving in 2023, which would probably have made p less than .05, but the Chi-Square test does not allow zero values, nor decimal places. In any case, the numbers are not exact, as he did not count them

exactly, as he did not at the time envisage this statistical test, nor the longitudinal within-subject study aspect, though he did not view the phenomena as being at all trivial, and accordingly his memory of the approximate facts as numbers is clear enough for the present purpose. Therefore, the result, in the context here, is very easily interpretable, and no substantial debate about statistical significance and its relationship to clinical significance could sensibly be entered into, in the opinion of the author. Now, as well as exposure to chainsaw chain effluent being suggested by the data as a causal factor in the etiology of the multiple keratoacanthomas here, the data also suggests that green-ant bites and/or mosquito bites and/or puncture wounds could also be causal factors. However, just in early 2021 he carried out 50 days of intensive full-time cleaning up (but only brush-cutter and pole-saw attachment for this were used, not chainsaws, so contact with cutting effluent was much less) of fire-risky plant matter on vacant blocks of land on the Southern Moreton Bay Islands, in the course of which he incurred hundreds of puncture wounds, roughly equally to both lower legs, mostly from standing on some twig or branch with one foot, causing the other end of it to be raised up, then bringing the other leg forward or backward in locomotion into that other end, whereupon a puncture wound would result, and there were multiple daily mosquito bites, and no keratoacanthoma was detected to result. Furthermore, the puncture wounds incurred on the little farm in North Queensland were roughly equally distributed to both legs. Therefore, these data taken together suggest that if puncture wounds are involved in the etiology of the keratoacanthomas it is only in interaction with some other factor, for example chainsaw chain effluent, which is taken to be the most likely cause here, given the association of machinery oils with keratoacanthoma having been previously reported in the literature, as noted above. Now the hundreds of green tree ant bites received on the little farm have no recent precedent elsewhere for comparison, only decades ago working on other farms, and then only very intermittently, not on a continuous near-daily basis. However, the green-ant bites, like the puncture wounds, were roughly equally distributed to the left and right legs. Likewise, the puncture wounds, then, if green tree ant bites and/or mosquito bites are involved in the etiology of the

keratoacanthomas, the data suggests that it is only in interaction with some other factor, for example chainsaw chain effluent. Furthermore, there could be a three/four-way interaction combining chainsaw chain effluent, puncture wounds, green tree ant bites (which involve delivery of formic acid, along with whatever else, to the very small bite wound), mosquito bites, or March fly bites. Further still, there is the possibility that deposition of sap on the skin (from either or both of chainsaw chain effluent and contacting weeping cut wood surfaces with the body) is involved in the etiology, again in the interaction with the other possible causal factors noted here above, but the data here is insufficient to derive anything other than just a mild suggestion that if so, pine sap might be less strongly contributing than some other sort of sap(s). Note that there is not the data here to allow meaningful statistical analysis of the likelihood of etiological contribution by puncture wounds, green tree ant bites, mosquito bites, or sap types. Likewise, low vitamin B12 / high homocysteine and assumed high beta-carotene, vitamin C and vitamin E.

CONCLUSIONS

In the context of legs being bare during operation of a chainsaw, it seems that in this case multiple keratoacanthomas resulted from exposure to the machine oil in the chainsaw chain effluent, likely in interaction with puncture wounds to the skin from plant parts, possibly with additional interaction with formic-acid-depositing green tree ant bites, and/or tree sap deposited as part of chainsaw chain effluent or through body contact with cut plant surfaces. Possibly UV exposure, and/or low vitamin B12 / high homocysteine may have had some underlying contribution to causation. There is a large amount of potential harm to worker health in the developing world from the use of chainsaws, involving both chainsaw internal combustion engine effluent, but also from chainsaw cutting chain effluent, the latter particularly in the case of the use of discarded motor vehicle engine oils as chainsaw bar/chain oil, in the absence of effective personal protective equipment and clothing, harm via, and to, both lungs and external body skin, and this potential harm is presently almost entirely unaddressed, let alone being effectively reduced.

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