ATLAS OF CALLUS

Forefoot callus classification and appearance

ConsultingFootPain

Adapted from his Master's Thesis 2016

David R Tollafield

Introduction

The following material was produced as part of my MSc degree in Podiatric Surgery Thesis during 2016 and based on clinical work with students at the University of Huddersfield.

In order to make this more accessible to readers, lay and academic, I have edited out majority of the text in order to leave the main portion – a visual concept of callus associated with the forefoot.

References remain at the end to aid further students interested in callus location and formation. The work actually started in 1983 and was first published in *The Chiropodist*, the journal at the time associated with the now Royal College of Podiatry.

The latter work was divided into three formal academic papers after the Thesis had been awarded from 2017 onwards. Readers can read all the original papers at ConsultingFootPain under published papers as part of ConsultingFootPain's open access policy. If any of these works are used please cite as appropriate.

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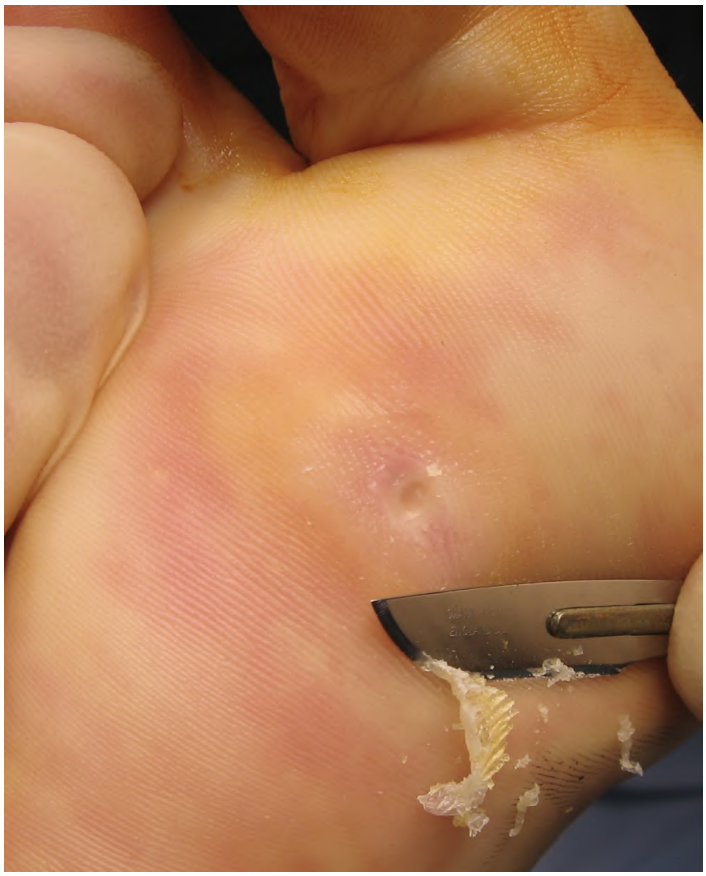


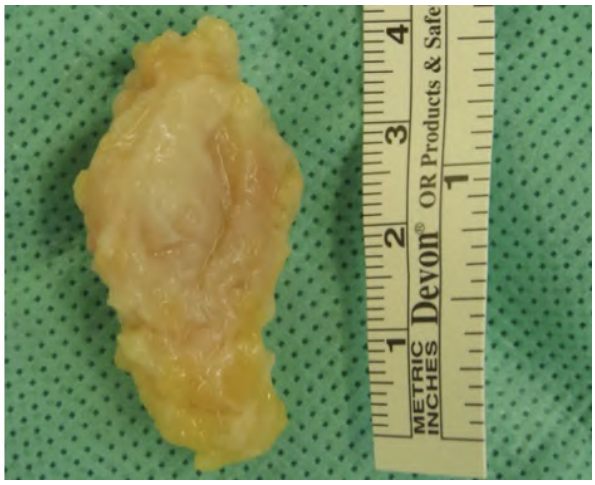
Method of debridement

The standard debridement process to reduce callus is used in podiatry. The reduction of the keratin bulk identifies damage at a lower level where the dermis and epidermis meet (epidermo-dermal junction).

This can be referred to as a keratoma or IPK, or fibrous corn. The classification embodies a Type 4 lesion in the illustration above which turned out to have a human papilloma viral infection following histological analysis under microscope, but also required full depth surgical excision and plastic repair.

Although the project does not look at histology, an appreciation of the sub-epidermal pathology remains critical particularly where the benefit provided by debridement is limited.

Source - Tollafield, personal clinical slide library with patient permission



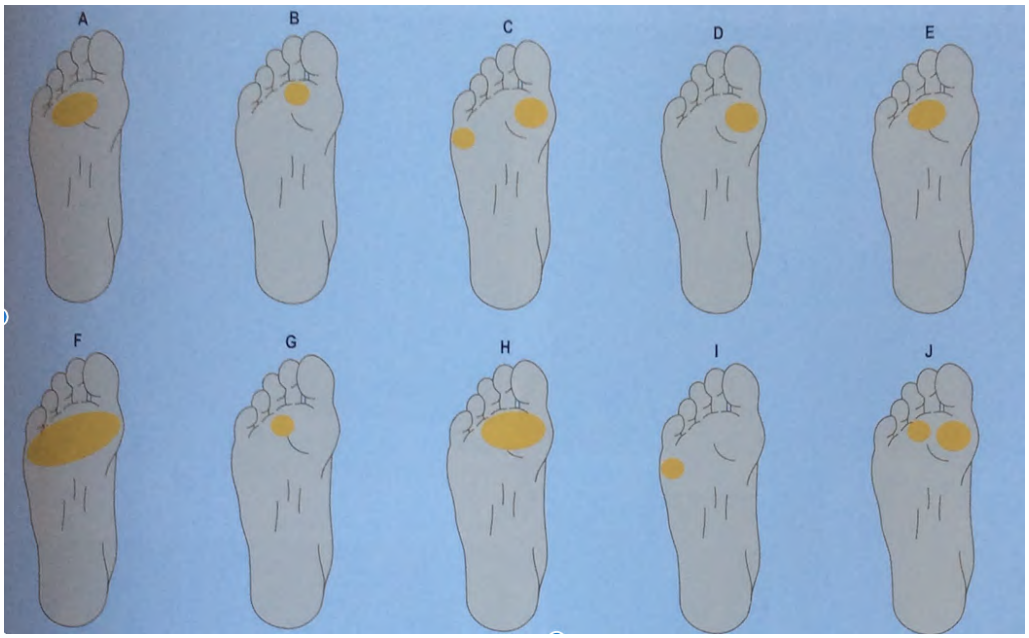
Bursa formation can lie hidden under moderate to mild callus. Case study from author's hospital.

Whiting (1997) suggests the relevance of deeper synovial damage below the dermo-epidermal junction.

The callus under the first metatarsal head while appearing thin and of little consequence (Type 1) has a necrotizing synovial cyst that has been surgically removed.

Simple debridement alone would not provide a satisfactory outcome for this patient, as the hypodermis would continue to result in atrophic damage.

Source – Tollafield, personal clinical slide library with patient permission.



Farndon et al (2015) considered 201 patients with variable numbers of corns. The study attempted to correlate an association with pain, disability and quality-of-life.

Plantar corns dominated over dorsal and interdigital lesions while the fifth metatarsal appeared dominant.

The Lesion Chart Guide

The lesion chart represented lesions graded as Type 1-4, based on Tollafield & Price (1985) descriptors, taking into consideration shades, borders and shapes within a box.

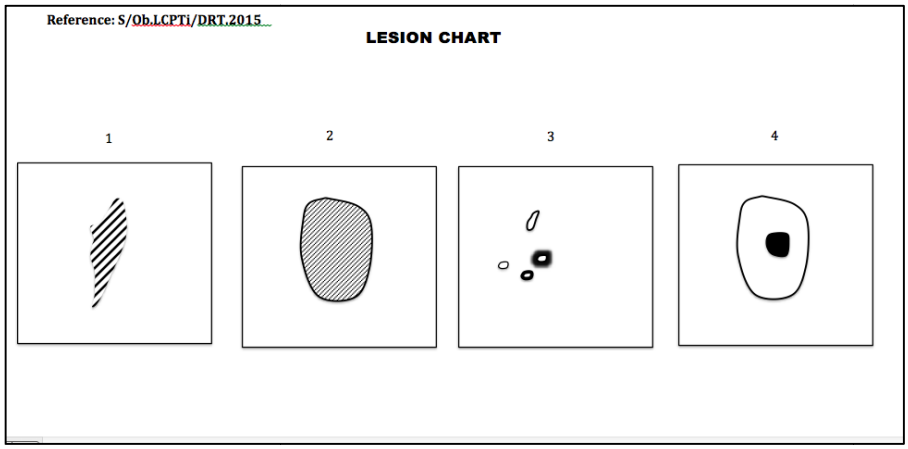
Descriptors have been divided in a controlled assessment -

1. Without a distinct border

2. Where a clear border exists without density changes

3. With small spherical seed like areas arise

4. With both a clear border and deeper density change

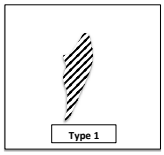
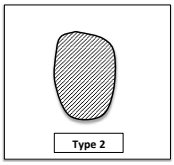


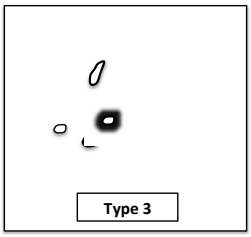
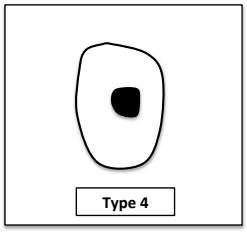
The Lesion Chart

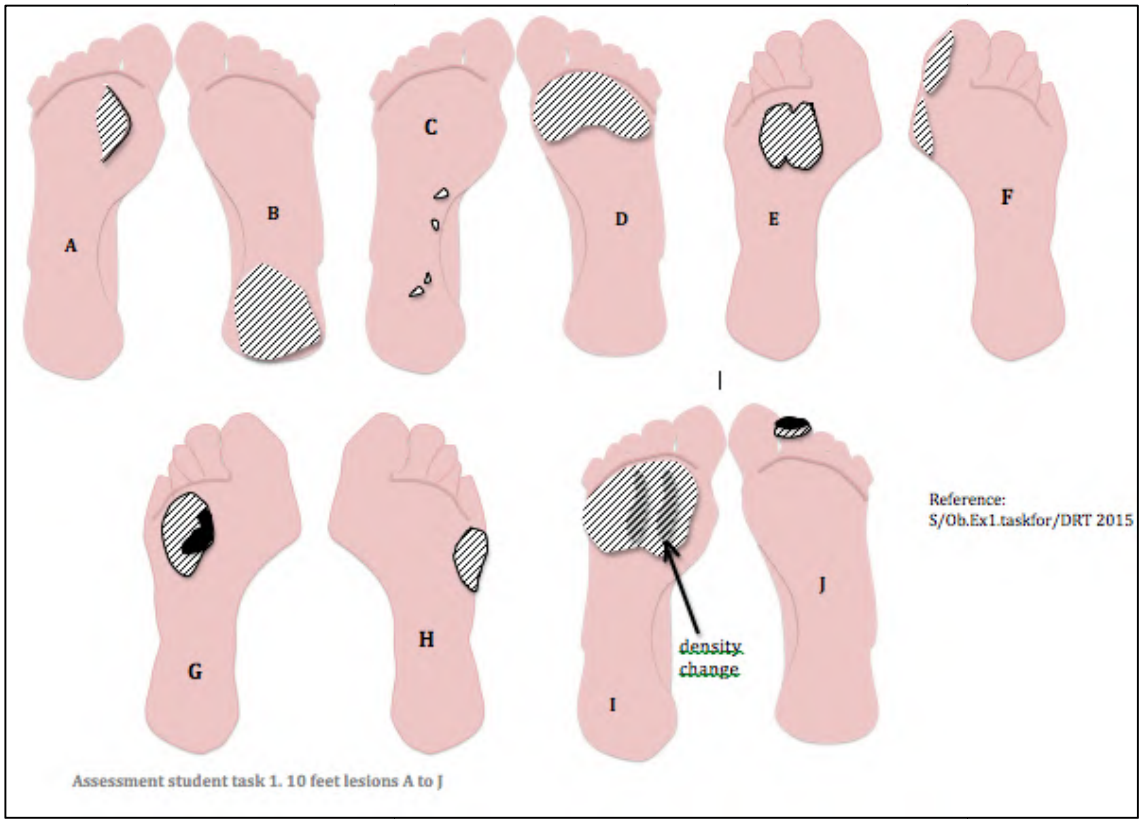
Simplified descriptor 'A'

Type 1	No border definition but retained uniform keratin depth (*shaded*). Ridged or pinch callosity can be considered within the Type 1 definition
Type 2	Border definition was present or partially present with variable keratin depth (*tighter shading with partial or complete border*). No discrete distribution of concentrated keratin is evident in the Type lesion but asymmetric density changes might be observed
Type 3	Concentrations of discrete keratin plugs isolated, or in groups of lesions, generally with a diameter of less than 4 mm (*small circle or oval shapes)* without background callus.
Type 4	Border definition present or partially present with variable keratin depth but demonstrating discrete distributions of concentrated keratin greater than 4 mm diameter (*small circle in larger circle*) within the callus

Detailed descriptor 'B'

	Old classification D[85]	New classification for project D[15]
	No callus lesion. Normal	No lesion. Even colour, thickness & consistency remain within normal limits for each part of the foot. Heel, sole and pulp of toes may be thicker. There would be insufficient epidermal tissue to debride without affording damage. There are no ridges, fissures or deep tissue changes or lesions within the skin. Keratin lesions associated with other forms of hyperkeratosis <u>do not</u> form part of plantar callus classification.
1	No specific callosity but diffuse or pinch  (striated) callosity	The epidermis is thickened and may have some irregular deeper density changes to alter the colour. Callosity shows <u>no border symmetry</u> and maybe diffusely spread without any concentrated area of keratinisation. Petechiae (blood vessels) may be seen or extravasated content. Pinch callosity, also known as ridging, is callus on the edge of the forefoot, occasionally sulcus, heel, or apex of a toe. The border may appear isolated as streaky (striated) of callus. While this type of callus may have a defined border it is considered type 1 because it conforms to physiological build up or deformity, and the deeper tissue changes are not involved as in Type 2 or Type 4.
2	Circumscribed or well-defined  thickening	A thickness of epidermis forms usually over one or more metatarsals or phalangeal surface of a toe. The <u>border is discrete</u> and <u>may be raised</u> forming a button or disc of thickening. If a partial border is observed, then this is classified as a Type 2 callus. Debridement may be necessary to determine any true nucleation. The underlying callus may be spongy and can only be determined by examination. Areas of flaky skin, complicated with sub epidermal hemorrhage do not constitute a nucleus of tissue and should be disregarded. If debrided the tissue is shown to have broken down, eroded, or ulcerated it no longer follows the callus classification but that of a wound.
3	Heloma type, durum or milliare without peripheral callosity	Usually a discrete circumscribed area but may be elongated. This lesion <u>has no surrounding callus</u> except at the extreme border where a thickened ring or rim may exist. The lesion is mostly associated with the metatarsal plantar skin where weight bearing is reduced and fat tissue is less pronounced, often with a less tightly bound epidermis. However, the lesion may not be associated with mechanical origins and can occur due to other causes including foreign body infiltration or HPV

		infection. If this is a suspected HPV then it no longer follows callus classification.
4	Callosity of well-defined nature with well-defined heloma lesion 	The callus will have a circumscribed symmetrical or asymmetrical area of greater depth, ridge, or greater concentration anywhere within the callus. The size can vary from lesion to lesion-occupying crater like areas after debridement. The nucleus does not have to be limited to the centre and can in some cases manifest within a larger percentage of the lesion. On debridement the base may be damaged as well as uneven in depth. As Type 4 calluses are considered typical of intractable lesions, these are often complicated within the dermo-epidermo junction. Extravasated material, without debridement confirmation cannot be assumed consistent with Type 4 lesions, but there may be density changes within the callus complicated by blood vessel disturbance. The same rule applies if the dermis is breached leading to a wound.



Diagrammatic illustrations A-J

The diagrammatic lesions can be used to test observation against Types 1-4. Page 10 provides the nearest fit.

Figure 'I' shows no border but does represent density variation deliberately added to make the lesion more complex for 'Typing'.

The lack of border added to testing the difference in descriptors between simple (A) and detailed (B)

Figure	Callus type 1-4	Figure	Callus type 1-4
A Partial border (*second metatarsal*)	**2**	**F** Two similar lesions (*great toe*)	**1**
B *Heel* with no border	**1**	**G** Single complex *metatarsal heads* 3-4	**4**
C Four lesions of the same origin but different shapes (*arch of foot*)	**3**	**H** Single lesion border (*fifth metatarsal*)	**2**
D All *Metatarsal heads* across ball of foot without a border	**1**	**I** Shows density changes (*whole ball of the foot)*	**2/4**
E Bilobed lesion outline (*metatarsals*)	**2**	**J** Single lesion second (*apex toe)*	**4**

Diagrammatic lesions should be compared to the Lesion Chart and the descriptors

Colour Plates

The 10 colour plates show the five feet (three cases) before and after debridement. A-E paired feet with their relative lesion Types.

Type 2 and 4 predominate and tend to cause more notable symptoms for patients.

Pre-debrided plantar lesions		Post-debrided plantar lesions
	A	
Type 4		Type 4
	B	
Type 2		Type 2

	C	
Types 2		**Types 2**
	D	
Type 4		**Type 4**
	E	
Types 4		**Types 4**

Atlas of Callus. Forefoot callus classification based on Master's Thesis 2016. D R Tollafield. Reproduced by Busypencilcase Communications

Observation – 6 Colour Plates

Six photographic images used for students and experts to test against best fit.

Method 2 - Corn or Callus lesion		Clinical description and classification
	3	Type 3 – Case 1 Corn enucleated cleanly with peripheral thickening at edge. No associated callus present.
	1	Type 1 – Case 2 Diffusely spread callus with undefined border
	4	Type 4 – Case 3 Plantar phalangeal lesion with extravasated material at joint line forming nucleated mass and deeper tissue change associated with damage

	2	Type 2 - Case 4 Border more notable at the antero-medial aspect under second metatarsal. No alteration of density is noted throughout the callus. Undebrided.
	4	Type 4 - Case 5 Deeper damage where the nucleus is asymmetrically located with variable depth changes. Lesion debrided.
	4	Type 4 - Case 6 Well defined border partially debrided with central mass demonstrating damage traditionally known as a neuro-vascular corn based on intractable nature of management of the lesion.

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