

The A to Z of Bone & Joint Failure

Dr A. L. Neill

BSc MSc MBBS PhD FACBS

The A to Z of Bone & Joint Failure

Introduction

When *the A to Z of Bones, Joints & Ligaments* was first written, I received requests to add an additional section dealing exclusively with the BACK. Hence, *the A to Z of the Bones, Joints, Ligaments & the Back* was written. This was well received, and generated a interest in the common features & failings of bones & joints. Normal bone re-models itself constantly and this feature is the cause of osteoporosis and other bone/joint pathologies, when it goes awry. This is the first time the A to Z format has been applied to a purely pathological topic. The title was in part suggested by Prof John Eisman who is very concerned with the devastating problem of Osteoporosis. After discussions with him, and also with Prof Barry Wren, and feedback - the idea of a book on the failure of aspects of the skeletal system was born, hence this small volume. It is the first in a series of ***the A to Z of failure***. The next one planned is a discussion on the failings of the cardiovascular system, ***The A to Z of Cardiovascular failure***.

Acknowledgement

Thank you Aspenpharmacare Australia for your support and assistance in this valuable project, particularly Greg Lan, and Rob Koster, and everyone who provided feedback. It is always greatly appreciated.

Dedication

I am lucky to have a small group around me who are supportive and loyal. Thank you. You know who you are!!! and of course to my A to Z darlings, who may be far away but are always on my mind. You know, I love you.

How to use this book

A basic anatomical knowledge of the Bones Joints & their associated structures is assumed in this book, and summarized in *the A to Z of Bones Joints, Ligaments & the Back*. There are 2 main sections in this book: a consideration of the normal tissues and the latter green section - a consideration of their pathological processes. The Appendix summarizes the major bone diseases as a table.

The Common Terms section also includes a number of pathological terms and diagrams.

This book is cross-referenced with all the other A to Zs.

The A to Zs may be viewed on 2 sites – www.amandasatoz.com and <http://www.aspenpharma.com.au/atlas/student.htm>

Thank you

Amanda Neill

BSc MSc MBBS PhD FACBS

ISBN 978-1-921930-03-4

Table of contents

INTRODUCTION	1
ACKNOWLEDGEMENT	1
DEDICATION	1
HOW TO USE THIS BOOK	1
TABLE OF CONTENTS	2
ABBREVIATIONS	5
COMMON TERMS IN OSTEOLOGY & PATHOLOGY	8
BONE CLASSIFICATION	35
BONE COMPONENTS	36
Bone Tissue Cell types	
cell – overview	36
cells - bone cell lines	38
Bone Marrow Cell types	40
Development of - Haemopoetic lines	40
BM – in situ	42
BONE FORMATION	44
Flat bones – intermembranous ossification	44
Long bones – endochondrial ossification	48
BONE – FRACTURES (#) breaks, cracks	52
Healing	52
Types	54
BONE MATURATION & GROWTH	56
Bone growth and alignment	
Lower limb (LL)	56
Stages of Ossification	58
Elbow joint	60
Foot & Ankle joints	62
Hand & Wrist joints	64
Hip joint	66
Knee joint	68
Shoulder joint	70
BONE STRUCTURE	72
Flat bone / Cancellous bone	72
Long bone / Compact bone	74
Mineralization – from CT – osteoid GS	78
Remodelling	80
BONES of the HUMAN SKELETON	84
Anterior / Posterior	84

CARTILAGE	88
Articular cartilage	88
Epiphyseal plate	90
JOINTS	92
Classification of Joints	92
Diarthrosis AKA SYNOVIAL Joint	94
Summary and range of Movements	96
GENERAL OSTEOPATHIC EXAMINATION TECHNIQUE	102
Regional Bone / Joint failures	108
The Ankle & Foot	
anatomy schema & radiological features	108
inspection	116
palpation	120
movement	128
The Elbow	
anatomy schema & radiological features	130
inspection	136
palpation	138
movement	142
The Hand, Wrist & Fingers	
anatomy schema	144
inspection & radiological features	146
palpation	158
The Hip – Pelvis & Femur	
pattern of disease presentation	160
anatomy schema & radiological features	162
inspection – shortening	168
palpation – movement	170
The Knee, Patella & Tibia	
anatomy schema & radiological features	172
effusions of the knee	182
extension failure	184
meniscal failure	186
Patella failure	188
Stability failure	192
anterior	194
lateral – varus	196
medial – valgus	198
posterior	200
tibial tenderness	202

The Shoulder & Humerus	
pattern of disease presentation	204
anatomy schema & radiological features	206
inspection	212
examination	214
movements	216
The Vertebral Column – Spine	
anatomy schema & radiological features	218
spondylolithesis	226
PATHOLOGICAL PROCESSES	
Lucent bone lesions	228
Necrosis = Cell / Tissue death	230
BONE & JOINT FAILURE index	
CONGENITAL / GENETIC FAILURES	
Osteogenesis Imperfecta AKA Brittle Bone Disease	234
Spina Bifida	236
FAILURE DUE TO INFECTION	
Osteomyelitis	238
FAILURE DUE TO INFLAMMATION	
Osteoarthritis	240
Rheumatoid Arthritis	240
MECHANICAL FAILURE / TRAUMA	
Biomechanics of weight-bearing joints	242
METABOLIC FAILURES	
Calcium & Phosphate regulation	244
Hyperparathyroidism / Hypoparathyroidism	248
Osteomalacia (& Rickets)	254
Hypercalcaemia	256
Osteoporosis – OP (& Osteopenia)	257
OP – minerals & vitamins	262
OP & Peak Bone Mass	264
Paget's disease AKA Osteitis Deformans	266
Vitamin deficiencies see Osteomalacia, Osteoporosis	
FAILURE DUE TO NECROSIS (LACK OF BS)	
Avascular (aseptic) bone necrosis AKA Osteonecrosis	270
FAILURE DUE TO NEOPLASIA	
common sites of primary bone cancers	272
Table of bone cancers – benign & malignant	274
APPENDIX	
Bone Diseases – their names & aetiologies	277

Abbreviations

A	= actions / movements of a joint	c	= cytoplasm
a	= artery	CD	= cluster of differentiation
aa	= anastomosis (ses)	c.f.	= compared to
AA	= alopecia areata	CFU	= colony forming unit
Ab	= antibody = IL	Clf	= chronic inflammation
Ab/Ag	= antigen antibody complex	CIN	= carcinoma in situ
ABC	= aneurysmal bone cyst	cm	= cell membrane
ACF	= anterior cranial fossa	CMC	= carpometacarpal
Alf	= acute inflammation	CMF	= chondromyxoid fibroma
Alm	= autoimmune	CN	= cranial nerve
adj.	= adjective	CNS	= central nervous system
Ag	= antigen	Co	= collagen
AKA	= also known as	collat.	= collateral
ALL	= anterior longitudinal ligament	CP	= cervical plexus
alt.	= alternative	Cr	= cranial
ANF	= anti nuclear factor	CSF	= colony stimulating factor
ANS	= autonomic nervous system	CT	= connective tissue
ant.	= anterior	D	= dermis / diaphysis
AP	= alkaline phosphatase	Dd	= deep dermis / reticular dermis
A / P	= anterior/posterior	DD	= differential diagnosis
AR	= allergic reaction	DE	= dermo-epidermal junction
art.	= articulation (joint w/o the additional support structures)	diff.	= difference(s)
AS	= Alternative Spelling, generally referring to diff. b/n UK & USA	DIP	= distal interphalangeal joint
assoc.	= associated (with)	dist.	= distal
B-	= bone marrow derived -	DLE	= discoid lupus erythematosus
B-AP	= bone specific alkaline phosphatase	DM	= Diabetes Mellitus
bc	= because	Du	= upper dermis / papillary dermis
BCC	= basal cell carcinoma	Dx	= diagnosis / diagnoses
BCR	= B-cell antigen receptor	E	= epiphysis / epidermis
BM	= bone marrow	EA	= epidermal appendages
bm	= basement membrane	EAM	= external acoustic meatus
BMD	= bone mineral density	EAS	= external anal sphincter
b/n	= between	EC	= extracellular (outside the cell)
br(s)	= branch(es)	e.g.	= example
BS	= blood supply / blood stream	EP	= epiphyseal growth plate
BV	= blood vessel	ER	= extensor retinaculum
Bx	= biopsy	er	= endoplasmic reticulum
C	= carpal / carpo	ES	= Ewing's sarcoma
		Ex	= examination
		ext.	= extensor (as in muscle to extend across a joint)

The A to Z of Bone & Joint Failure

ext.	= extension	LBP	= low back pain generally assoc with prolapsed disc
F	= fat	LL	= lower limb
f	= fluid	lig	= ligament
Fab	= antibody binding fragment	longit.	= longitudinal
FB	= fibroblasts	LOF	= loss of function
FC	= fibrocytes	LP	= low powered magnification
Fc	= fragment –crystal region	Lt.	= Latin
flex.	= flexor	M	= meta
flex.	= flexion	m	= muscle
FR	= flexor retinaculum	MC	= metacarpal / metacarpo
GF	= growth factors	MCF	= middle cranial fossa
GH	= growth hormone	MCP	= metacarpophalangeal
gld	= gland	med	= medial
GIT	= gastro-intestinal tract	mito	= mitochondria
Gk.	= Greek	MM	= mucous membrane
grp	= group	MNC	= mononuclear cells
GS	= ground substance	MO	= microorganisms
H	= hormone	MP	= medium magnification
HA	= hydroxyapatite	M/P	= medial / lateral
Histo	= Histology	MRC	= medical research council
HP	= high powered magnification	MT	= metatarsal
Hx	= history (of the disease)	mΦ	= macrophage
IAS	= internal anal sphincter	N (s)	= nerve(s)
IC	= intercarpal / intercarpo	NA	= nucleic acids
If	= inflammation	NAD	= normal (size, shape)
IfR	= inflammatory response / reaction	NAD	= no abnormality detected
Ig	= immunoglobulin	NK	= natural killer
IL	= interleukins = immunoglobulins = Ab	No	= nucleolus
Im	= immune	NOF	= neck of Femur
In	= infection	NR	= nerve root origin
INF	= interferon	NS	= nervous supply / nerve system
inf	= inferior	NT	= nervous tissue
IP	= interphalangeal	Nu	= nucleus (nuclei)
IR	= immune response / reaction	nv	= neurovascular bundle
Ix	= investigation of	OA	= osteoarthritis
ly	= injury	OB	= osteoblasts
jt(s)	= joints = articulations	OC	= osteoclasts
l	= lymphatic	OG	= osteoprogenitor cells = bone stem cells
L	= lesion / left	OP	= osteoporosis
lat	= lateral	OS	= osteosarcoma
LB	= long bone	P	= pressure / pus

PAD	= peripheral arterial / vascular disease	subcut.	= subcutaneous (just under the skin) as a site
PaNS.	= parasympathetic nervous system	sup	= superior
ParaNs	= parasympathetic nerves ± fibres	supf	= superficial
partic	= particular(ly)	SyNS	= sympathetic nervous system
PBM	= peak bone mass	T	= tissue
PCF	= posterior cranial fossa	TCR	= T cell receptor
PH	= parathyroid hormone	TJC	= tight junctional complex
pH	= a measure acidity	Tm	= tumour(s)
ph	= phalangeal / phalanges / phalango	TNF	= tumour necrosis factor
PIP	= proximal interphalangeal joint	TP	= transverse process
pl.	= plural	Tx	= treatment / therapy
PLL	= posterior longitudinal ligament	UL	= upper limb, arm
PMNs	= polymorphonuclear cells = polymorphs	v	= very
PN	= peripheral nerve	V	= vertebra / vein
post.	= posterior	VB	= vertebral body
proc.	= process	VC	= vertebral column
prox.	= proximal	VDRL	= Venereal Disease Research Laboratory (test for syphilis)
PS	= pubic symphysis	w	= visa versa
PSU	= pilo-sebacious unit	w	= with
PVD	= peripheral vascular disease	WBCs	= white blood cells
Px	= progress	w/n	= within
R	= right / resistance	w/o	= without
RA	= rheumatoid arthritis	wrt	= with respect to
ROM	= range of movement	&	= and
RSTL	= relaxed skin tension lines	∩	= intersection with
RT	= respiratory tract	#	= fracture
S	= strata/stratum /sacral		
SC	= spinal cord		
SCC	= squamous cell carcinoma		
sing.	= singular		
SE	= side effects		
SLE	= systemic lupus erythematosus		
SN	= spinal nerve		
SP	= spinous process / sacral plexus		
SPF	= sun protection factor		
SS	= signs and symptoms		
STL	= skin tension lines		
Su	= subcutaneous T / fat		

Common Terms in Osteology & Pathology

A

Abcess (*AB-sess*) localized collection of pus

Ablation (*AB-lay-shon*) the removal of part of the body, generally a bony part, most commonly the teeth

Achilles (Achilles') tendon AKA Calcaneal tendon, Tendo Calcaneus posterior tendon posterior leg tendon – longest & strongest in the body – 15 cm long up to 4cm wide – joins the posterior muscles to the heel bone

Acro (*AK-roh*) (*adj acral*) *Gk akron = extreme* end, extremity, peak, tip, denoting something at the extremities ankles / fingers / wrists

Acromegaly (*AK-roh-meg-al-ee*) adult form of hyperpituitarism – the ends of the long bones continue to grow: coarsen the facial features and digits

Acute (*AK-yewt*) sudden onset + short course – used to describe a condition generally pathological ≠ chronic

Adaptive immunity = Adaptive IR = Aquired IR the response of Ag-specific lymphocytes to Ab, including the development of immunologic memory. Adaptive IRs are distinct from the innate & non-adaptive phases of immunity, which are not mediated by clonal selection of Ag-specific lymphocytes *see also Immunity*

Adnexa (*AD-nex-uh*) appendage, limb extras *pl adnexae* (*AD- nex-ee*)

Ala (*AY-lar*) a wing, hence a wing-like process as in the Ethmoid bone *pl. - alae.*

Alkaline Phosphatase (*ALK-u-lyn FOS-fat-ayz*) – an enzyme responsible for cleaving the phosphate ion in ATP – ie as a marker of energy consumption – as such it is present on all cells – but specific iso-enzymes may be distinguished – so that bone specific – alkaline phosphatase (B-AP) measures the bone energy activity & is specific to the activity of OBs – bone being formed.

Allergy (*AL-er jee*) abnormal IR to a substance

Alta Lt. on high elevation

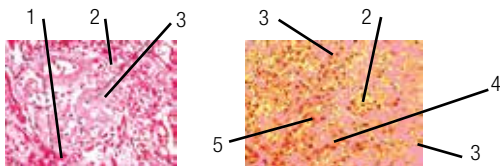
Alveolus (*AL-vee-oh-lus*) air filled (bone - tooth socket) *adj - alveolar* (as in air filled bone in the maxilla)

Amorphous (*AY-mor-fuss*) shapeless, structure less

Amputation (*AM-pew-tay-shon*) to cut off, to prune, to cut off a limb or appendage

Amyloid (*AM-uh-loyd*) proteinaceous substance of varying composition, which appears similar histologically

Amyloidosis – group of diseases characterized by extracellular deposition of the amyloid (3) in Ts & organs – displacing the normal structure e.g. the renal glomerulus (2) or the sinusoids of the liver (4), causing cell & T death (5) & leaving protein casts of their presence (1).



Anaphylaxis (*AN-uh-fill-ax-sis*) exaggerated reaction to a foreign body = acute severe IR

Anatomical position the reference position, in which the subject is standing erect with the feet facing forward, arms are at the sides, & the palms of the hands are facing forward (the thumbs are to the outside).

Anaesthesia loss of sensation

Anatomy (*ah-NAH-to-mee*) the study of the structure of the body.

Ankle bend = angle usually referring to the bend just above the foot, hence the ankle is the joint b/n the foot & LL

aniso unequal

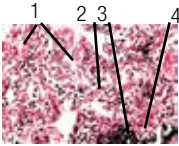
ankylos – (*an-KEE-los*) **stiff / stiffening – often referring to something becoming calcified**

Ankylosis a fixed bending of the jt – unable to straighten – always pathological

Anlage (*AN – lag*) **Ger act of laying** = primordium – a clustering of embryonic cells to form an organ or structure

Annulus fibrosus the peripheral fibrous ring around the intervertebral disc

Anteversion – leaning forward



Anthracosis (*AN-thrak-oh-sis*) common benign asymptomatic deposition of carbon (3) in cells macrophages (2) or walled off by fibrosis (4) – generally in lung T (1) but may occur in skin (tattoos)

Antibiotic (*ant-EE-BYE-o-tic*) a substance which can be ingested & used to kill MOs specifically bacteria in the body.

Antibody / Antigen proteins involved in the immune system – antibodies Abs are produced by the body in reaction to antigens Ags proteins or materials found on the surface of foreign bodies introduced to the body forming the antibody-antigen complex

anti– against

Antibodies *see also Immunoglobulin* self molecules which are synthesized by the Im cells after being exposed to Ags

Antigen (Ag) usually a foreign macromolecule that triggers the IR & the production of Abs & other immune active molecules e.g. TNF.

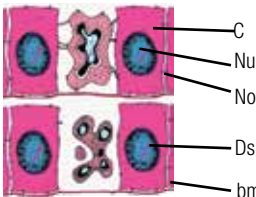
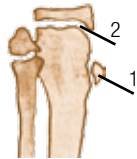
Antigen – presenting cells *see Dendritic cells.*

Anti-inflammatory anything which ↓ If by acting on body responses

Aperture (*a-PET-tyuu-a*) an opening or space b/n bones or w/in a bone.

apo– away from / detached

Apophysis (*APO-fe-sis*) = **tuberosity / tubercle** cartilage which connects bone to bone or tendon to bone, in young bones (1) but not a true EP (2) – does not function to ↑ LB length. It is subject to tearing – and separation in overtraining of the young



Apoptosis (*a-POP-toe-sis*) **Gk aptos = to drop out** individual cell death – programmed cell death due to organ conditions – natural cell death – ≠ Necrosis

Appendicular refers to the appendices of the axial i.e. in the skeleton, the limbs upper & lower which hang from the axial skeleton, this also includes the pectoral & pelvic girdles.

The A to Z of Bone & Joint Failure

Arbor *Gk treelike branches* – arborizing, branching

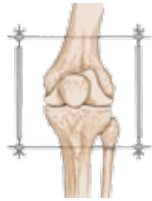
Areola small, open spaces as in the areolar part of the Maxilla may lead or develop into sinuses.

arth- to do with joints hence...

Arthritis (*AR-thrye-tis*) Inflammation of a joint

Arthrogryposis jt contractures

Arthrodesis complete loss of movement in a jt due to surgical ablation – i.e. fusing of the joint – used for pain and loss of mobility – an artificial ankylosis or syndesis



Arthropathy diseases of the joints

Arthroplasty – surgical manipulation of a jt – i.e. its removal or remodeling

Arthrosis AKA **arthritis** – lower lf involvement in the disease process

Articulation joint, description of the bone surfaces joining w/o the supporting structures = point of contact b/n 2 opposing bones hence the articulation of Humerus & Scapula is the articulation of the shoulder joint. **adj articular**

Artifact (*AH-te-fact*) **AS Artefact** – any distortion seen in the histological or radiological processing of material

Atopy (*AY-toe-pee*) – out of place adj atopic

Atrophy (*a-TROH-fee*) **Gk a = lack of, trophe = nourishment** wasting away deterioration of a T or organ from lack of use or food

Atypical not normal, unusual presentation of a phenomenon or structure

auto- (*OR-toh*)- **self**

Autoimmune (AIm) pertaining to cells & Abs that arise from & are directed against the individual's own tissues i.e. against "self"

Attrition tooth wear & tear

Atypical (*AY-tip-i-cal*) not usual –often used to describe possible cancerous cells or tissue

audio (*OR-dee-oh*) **pertaining to hearing, or to the ear.**

Auditory exostosis = a bony growth on the walls of the EAM (swimmer's ear)

Autolysis (*OR-tol-e-sis*) – the process of self destruction of a cell or tissue

Autopsy (*OR-top-see*) the examination ± dissection of a body after death – usually to lx cause of death / verify the diagnosis

Avulsion (*AY-vul-shon*) forcible tearing away of a structure or part of a structure as in an avulsed fracture where a fragment bone is torn away from the main bone

Axis (*AK-sis*) **adj axial** (*AK-see-el*) refers to the head & trunk (VC, Ribs & Sternum) of the body – not arms or legs

B

B cells = B lymphocytes 1 of the 2 major types of lymphocyte. B means the cells come originally from the BM **see also Plasma cells, T cells**

Ball and Socket generally referring to a joint which resembles a ball sitting tightly in a socket - very stable, limited range of movement e.g. hip joint

Basement membrane (bm) a thin layer of extracellular fibrillar protein matrix & CT stroma that underlies all epithelial cells

baso- base (as in acid / base; as in the bottom – the basal layer) **adj basal**

Basophils – granulocytes of the Im system which take up base staining because of high acid cytoplasmic granules **see also Acidophils, Neutrophils & PMNs**

Basocranium bones of the base of the skull

Basophil (*BAS-oh-fil*) a type of WBC that is characterized by large cytoplasmic granules that stain blue with basic dyes.

Benign (*BEE-nine*) not harmful or dangerous, ≠ malignant, indicating a mild disease. In cancer it is used to describe a mild & non-metastasizing cellular growth.

Biopsy (Bx) (*BY-op-see*) a piece of T removed for microscopic examination – usually from a live person

-blast immature cell / undifferentiated cell

Blount's disease **see Tibia Vara**

Bone (*BOH-n*) a CT that contains a hardened matrix of mineral salts & collagen fibers. Bone cells include: osteoblasts, osteocytes, & osteoclasts.

Bone Mineral Density (BMD) AKA Bone density a score indicating the amount of bone mineral g/cm^2 . It is used as a direct measure of the risk of # and OP. Sites measured are generally high risk # sites of OP – the hip and lumbar spine but any bone is possible to measure. Results are expressed in g/cm^2 , note this is not a volumetric measure & so the bone measured is very relevant. T & Z scores determine the type of bone normal osteopenic or osteoporotic

T-score, the number of standard deviations above or below the mean for a healthy 30 year old adult of the same sex & ethnicity as the patient.

normal > -1.0 / osteopenia -1.0 to -2.5 / OP < -2.5

Z-Score, the number of standard deviations above or below the mean for the patient's age, sex & ethnicity.

Bone spur **see osteophyte**

Boss a smooth round broad eminence - mainly in the frontal bone ♀ > ♂

Bowlegged **see Genu Varus** note there is some confusion here as the term Vargus is also used – but for clarity it is not used here - if this is due to tibial malformation & not a disease of the knee jt per se **see Tibia Vara**

Brachial (*BRAY kee-al*) arm, mainly to do with the upper arm

Bregma refers to a junction of more than 2 bones in a jt as in the Bregma of the skull, junction b/n the coronal & sagittal sutures which in the infant is not closed & can be felt pulsating

Buccal pertaining to the cheek

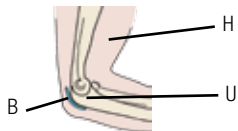
Bunion **Gk bounion = turnip** abnormal prominence on the inner aspect of the 1st MT head + a bursa & valgus (lat) displacement of the Hallux (big toe)

Bunionette AKA Taylor's bunion enlargement of the lat aspect of the 5th MT head

Bursa (*BER-suh*) a flattened sac containing a film of fluid (B), found around jts to allow for movement.

pl bursae e.g. the Elbow jt bursa. b/n Humerus (H) & Ulna (U)

Bursitis If of the bursae



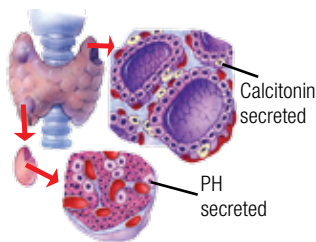
C

Calcaneus (*KAL-kan-ee-us*) heel, hence the bone of the heel **adj calcaneal**.

Calcaneal tendon **see Achilles tendon**

Calcar a spur **adj calcaneal**.

Calcinosis (*KAL-sin-oh-sis*) deposits of Calcium in body Ts &/or organs



Calcitonin H secreted by the parafollicular cells of the thyroid gland (1) opposing Ca mobilization – it ↓ Ca being absorbed in the GIT – being reabsorbed in the renal tubules and being mobilized from bone by ↓ OC activity, and ↑ OBs. Its activities are generally not significant as they are over-ridden by PH secreted by the parathyroid gland (2).

Calculus (*KAL-que-lus*) mineral deposit in T **see also stone**

Callus (*KAL-us*) hard T formed in the osteogenic layer of the periosteum as a # repair, replaced over time with compact bone

Calotte (*KALoh-tee*) the Calotte consists of the Calvaria from which the base has been removed.

Calvaria the Calvaria are the bones of the Cranium w/o the facial bones, attached.

Camptodactyly congenital flexion disorder of the PIP, generally affects the little finger

Canal tunnel / extended foramen as in the carotid canal at the base of the skull

adj canular

Canaliculus small canal

Cancellous bone = Trabecular bone a spongy, porous bone, lightweight with bone spicules or trabeculae parallel to lines of force found at the ends of LBs (epiphyses) with surrounding BM, found sandwiched b/n lamellae of compact bone, in the VBs & in areas of ↑ bone thickness

Cancer (*KAN-ser*) group of diseases where the cells w/o the normal controls

Capitulum diminutive of Caput, little head

Capsule (*KAP-syoo-l*) an enclosing membrane

Caput / Kaput the head or of a head, **adj capitata = having a head (c.f. decapitate)**

Carcinogen (*KAR-sin-oh-jen*) material which leads to cancer formation

Carcinoma (*KAR-sin-oh-mah*) a malignant growth originating from epithelial cells ≠

Sarcoma

Carcinoma – in situ pre-invasive cancer still lying in the confines of normal tissue not having broken through the bm but with neoplastic changes



Carpal Tunnel the tunnel formed by the wrist bones (carpal bones) to allow the passage of the flexor tendons & Ns to the hand & fingers, bound superiorly by the palmar fascia

Carpo wrist

Carpometacarpal generally referring to the jt b/n hand & the wrist bones

Cartilage (*KAR-tih-lehj*) a type of CT characterized by the presence of an extensive matrix containing a dense distribution of proteins & a thickened GS.

Caseous (*KAY-zee-us*) cheeselike – a form of necrosis

Cavity (*KAV-it-ee*) an open area or sinus w/in a bone or formed by 2 or more bones (**adj cavernous**), may be used interchangeably with fossa. Cavity tends to be more enclosed fossa a shallower bowl-like space (e.g. Orbital fossa-Orbital cavity).

Cavum a cave **adj cavis**

Cell (*SELL*) the basic living unit of multicellular organisms.

Cephalic pertaining to the head

Cerebral Palsy brain disorder generally from birth or post-In which results in poor muscle control & so leads to bone deformities due to poor coordination & limbs being held in abnormal positions

Cervico- pertaining to the neck

Charcot jt =neuropathic jt

chondro- (*KON-droh*) referring to cartilage

Chondrium (*KON-dree- um*) the cartilage **adj chondria, chondral**

Chondrocyte (*KON-droh-site*) a mature cartilage cell.

Chondrocalcinosis (*KON-droh-kal-sin-oh-sis*) metabolic disorder where calcium deposits are found in jts leading to their destruction - much like gout with uric acid

Chondroitin sulphate (*kon-DROI-tin SUL-fate*) a semisolid material forming part of the EC matrix in certain CT.

Chondroma (*KON-droh-mah*) benign Tm of cartilage T origin

chromo- (*KROHM-oh*) referring to colour **adj chromatic**

Clinoid like a bed-post, part of a 4-poster bed so that clinoid process looks like a bed post (generally with other posts) as in the Sphenoid bone.

Clavicle little key = S-shaped bone = collar bone

Clivus a slope hence in the ACF referring to a slope on the base of the cavity.

Clones series of cells which are identical to each other; in the IR these are lymphocytes which all produce the same Ags &/or cytokines

Club foot AKA Talipes equinovarus

downward inward pointing foot deformity



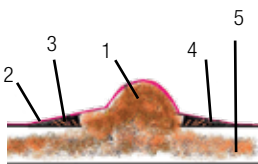
Clusters descriptive term for multiple cells seen to be together but not orientated in any particular manner as opposed to **nests**

Clusters of differentiation (CD) immune cells which express glycoproteins on their surfaces & are seen to act together – specific molecules may be referred to as numbers as in CD4 cells (used to be called leu-3)

Clusters of PMNs used to indicate areas of AI filled with PMNs (neutrophils which have left the BS)

Coagulation (*KOH-ag-you-lay-shon*) process of clotting turning from a liquid to a solid or semi-solid

Cochlea (*KOK-lee-uh*) a snail hence snail-like shape relating to the Organ of Corti in the ear.



Codman's triangle subperiosteal bone reaction to aggressive bone cancers e.g. osteosarcoma – (1). As the periosteum (2) lifts new bone T forms a triangle (2) b/n the bone & the periosteum via sunray spicules (4). These normal bone spicules develop in reaction to the detached periosteum, from the normal bone (5) underneath not replaced yet by Tm.

The A to Z of Bone & Joint Failure

Collagen (*KOL-a-jen*) the major fibre of the body; in CT, tendons ligaments & extracellular substances of many Ts



Colles Fracture AKA Colles' fracture # of the distal Radius at the cortico-cancellous junction – looks like a bent fork & sometimes called the fork #. Initially this # excluded Ulna involvement but now this is not always the case & loosely the # may be used to describe any distal forearm #. Common result of falling with an outstretched arm – common # of OP.

Compact bone = Cortical bone = Dense bone bone found in the shafts & on external bone surfaces. The structure is variable & constantly being remodeled throughout life. It may consist of osteons &/or lamellae.

Complement *Lt to fill up or fill out* an entire protein cascade in the BS activated by the presence of bm &/or necrotic cell components, may also be activated in the Ts by allogens – allergic Ag

Complex in IR the combining of 2 factors involved in the IFR or the IR e.g. an Ag & Ab complex which combines to activate or further develop the process

Concha (*KON-kuh*) a shell shaped bone as in the ear or nose (*pl. conchae adj chonchoid*) old term for this turbinate.

Condylar resorption AKA idiopathic condylar resorption process where the condyle of the TMJ is spontaneously resorbed reducing the size of the mandible & affecting the bite – generally seen in adolescent females

Condyle (*KON-dial*) a rounded enlargement or process – used in ref to a number of bones – commonly the TMJ jt

Congenital (*KON-jen-it-al*) present from birth

Connective tissue (*kon-EK-tiv Tish-ew*) (CT) one of the 4 basic types of tissue in the body. It is characterized by an abundance of EC material with relatively few cells & functions in the support & binding of body structures.

Cornu a horn (as in the Hyoid)

Corona a crown. *adj coronary, coronoid or coronal*; hence a coronal plane is parallel to the main arch of a crown which passes from ear to ear (*c.f. coronal suture*).

Cortex the rind or the bark of the tree

Costo/Costa – pertaining to the ribs

Coxa hip

Coxa Plana AKA Perthes disease

Coxa Valga, Norma, Varga with the changing of the femoral angle the Femur exits differently –leading to hip displacement & a limp

Cox algia hip disease

Cranium the cranium of the skull comprises all of the bones of the skull except for the mandible.

Crepitus (*Krep-i-tus*) a grating sensation on jt movement, often present in arthritis; described as bone-on-bone rather than on the articular cartilage

Crest prominent sharp thin ridge of bone formed by the attachment of muscles particularly powerful ones e.g. Temporalis/Sagittal crest

Cribiform / Ethmoid a sieve or bone with small sieve-like holes.

Crown = Vertex the top of the organ or body

Crura *adj cruris* leg

Cuneate /Cuneus a wedge / wedge-shaped (bone)

cyst- (*SIST*) bladder / fluid filled sac

Cyst nodule/tumour filled with liquid semi-solid material lined by epithelium – as opposed to unlined fluid in the **pseudocyst** *adj cystic*

-cytes (SYTS) mature cell types

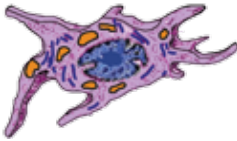
cyto- cellular

Cytokine (SY-to-kyn) any substance – generally small proteins made by a cell that affects the behaviour of other cells. Substances made by lymphocytes, act via specific cytokine receptors on the cells that they affect **see also Lymphokines, Interleukins (IL).**

Cytotoxic poisonous to cells – may cause cell death

D

dactyly – digits



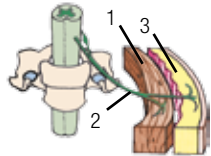
Dendritic (stromal) cells AKA Langerhans cells AKA Antigen presenting cells BM-derived star-shaped/treelike tissue resident phagocytic cells – potent T cell stimulators using Ags attached to stimulate activity, from the monocyte line.

dendro- tree-like formation

Dens a tooth hence dentine & dental relating to teeth, denticulate having tooth-like projections **adj dentate see also odontoid**

Depression a concavity on a surface

Dermatome section of skin (3) supplied by a single NR (2) as opposed to myotome (1) – which is the area of muscle supplied by a single NR – skin & muscle supplied by the same NR are generally closely associated



Diaphysis (DY-af-i-sis) the shaft or body of a LB. In the young this is the region b/n the growth plates & is composed of compact bone.

pl.= diaphyses adj.= diaphyseal

Diarthrodal jt = synovial jt = moveable jt

Dislocation when a bone is “out of place” out of its socket – or joint position **see also Subluxation**

Diastasis separation – may mean separation of a muscle from its original position as in pregnancy; or a bone from its original position w/o # – as in tendon rupture

Differentiation the changing of cells to become increasingly specialized

Diploë the cancellous bone b/n the inner & outer tables of the skull, **adj diploic.**

Distal further away from the axial skeleton (opposite of Proximal)

Dolor pain 1 of the 5 cardinal signs of IF

dorsi- back

dys- (DIS) Gk bad sign abnormal, bad, difficult, disorganized, painful (opposite to eu)

Dysplasia (DIS-play-zee-yah) abnormal growth of T or cells

Dysraphism any spinal abnormality of incomplete closure or malformation including spina bifida

E

Eburnation 2^o thickening of the bony end plate (often due to OA)

Edentulous w/o teeth

Effector cells describes those lymphocytes which develop from naïve lymphocytes after initial activation by Ag. They mediate the removal of pathogens from the body w/o further differentiation. Naïve lymphocytes & memory lymphocytes must differentiate &/or proliferate before they become effector lymphocytes.

Effusion excess synovial fluid – in the jt

Elbow any angular bend, e.g. in the UL, referring to the jt b/n the arm & forearm

Eminence a smooth projection or elevation on a bone as in iliopubic eminence.

Enchondroma benign cartilaginous Tm growing on the inside of the bone – surrounded by a bony case – located in the BM, may be a lump of T which never ossified rather than a new cartilage growth **see also chondroma**

Endocranium refers to the interior of the “braincase” **adj endocranial** divided into the 3 major fossae anterior (for the Frontal lobes) middle (containing Temporal lobes) and posterior (for the containment of the Cerebellum).

Endogenous growing from w/in tissues or cells

Endostium a mesodermal CT which lines the inner surface of all bones & is the conduit for the NS & BS of the bone. Lifting of the endosteum causes cancellous bone to be laid down to fill the gap b/n the bone & the cellular layer & this device may be used to encourage bone growth/repair.

Enostosis = boney island a boney growth of compact bone w/in a bone – generally on the internal surface in the trabecular bone harmless incidental finding – DD prostatic metastasis

Epiphysis the end of a LB beyond the growth plate or EP. Generally develops as a 2^o ossification centre. There are 2 epiphyses to each LB. Of a LB the shafts are generally compact bone & the ends = epiphyses are trabecular bone with a compact bone covering **pl. = epiphyses adj epiphyseal**

Excrescence outgrowth from a surface – e.g. normal fingernail / abnormal wart or exostosis

Exostosis a bony outgrowth from a bony surface, often due to irritation (as in Swimmer’s ear) & may involve ossification of surrounding Ts such as muscles or ligaments.

F

Facet a face, a small bony surface (occlusal facet on the chewing surfaces of the teeth) seen in planar joints.

Falciform (*FAL-see form*) relating to shapes that are in a sickle shape so falciform ligaments curve around & end in a sharp point

Fascia (*FASH-ee-ah*) **Lt = a band** a sheet or band of fibrous T deep in the skin covering & attaching to deeper tissues

Fascicle (*FAS-ih-kul*) small bundle

Fc receptor the section of the cm which binds the Fc portion of the Ab (IL).

Fever a generalized ↑ in body temperature due to an ↑ BF, which may be due to the body’s lfr

Femoral angle the angle b/n the femoral head & the shaft normal 120° – 135°, Valgus >135°, Varus < 120°



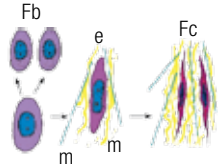
Femoral anteversion a leaning forward of the femoral head so that the Femur is rotated & the child becomes knock-kneed ± Patella rotation ± Tibial rotation – developmental rotation which generally spontaneously corrects itself in infancy with re-alignment of the LL – common sitting position is the W – a position preferred by the child.

Fibrino-inflammatory exudates due to IFR with both fibrin & inflammatory components

Fibroblast an immature progenitor cell found in all CT, capable of mitosis, migration, movement. Among other pathways they develop into fibrocytes.

Fibrocyte mature fibre producing cell = mature

fibroblast spindle shaped cell producing either collagen (col) or elastin (e) fibres via secretion of monomer units (m) which assemble outside the cell into long fibres, which are then maintained by the fibrocytes. Note with age the number of fibrocytes & hence the fibres ↓ hence compromising the integrity & strength of their CT. **See also bone development / structure main text.**



Fibrocartilagenous stroma background T of cartilage with high collagen fibre component

Fibromatosis fibrosis w/n a fascial sheath

Fibrosis (*FY- broh-sis*) ↑ fibrous T, generally collagen fibres as in scars; can occur in all organs

Fissure a narrow slit or gap from cleft.

Fontanelle a fountain, associated with the palpable pulsation of the brain as in the anterior fontanelle of an infant. These soft spots on the skull are cartilaginous CT coverings “joints” which allow for skull cranial expansion & then become the mould for the bone development & shape joining long the sutural lines, later becoming the Bregma.

Foramen a natural hole in a bone usually for the transmission of BVs &/or Ns. *pl. foramina*

Fornix an arch

Fossa a pit, depression, or concavity, on a bone, or formed from several bones as in temporomandibular fossa. Shallower & more like a “bowl” than a cavity

Fovea a small pit (usually smaller than a fossa) - as in the fovea of the occlusal surface of the molar tooth.

Fracture (#) = break hence ... **see main text**

Fusiform spindle-shaped – many CT cells are of this shape particularly fibrocytes.

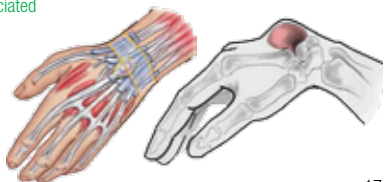


G

Gallus/Galli a cock, hence, crista galli, the cock's comb (*i.e. possessive form of gallus*)

Gamma Gk letter shaped like a “Y” and used to describe shapes of immunoglobulins

Ganglion a cystic swelling associated with jts &/or tendon synovial sheaths generally on the dorsal surface of the hand or wrist – fibrous capsule containing viscous fluid herniated from the jt /tendon capsule – may press on a N or jt & cause pain



The A to Z of Bone & Joint Failure

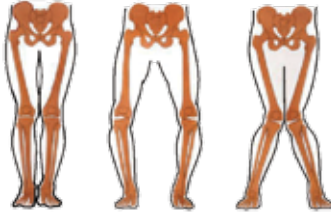
Gene (*JEEN*) a functional unit of heredity that occupies a specific place on a chromosome & directs the formation of a protein.

Genu (*JEN-you*) knee **adj genio** referring to the knee

Genu Recurvatum – hyperextension of the knee jt

Genu Valgus – knock-kneed (“G” knocking together)

Genu Varus – bow-legged (**AR – AIR** in b/n)



Genu Norma

Genu Varus

Genu Valgus

Gigantism – overgrowth of the length of the LBs due to excess GH before the fusion of the LBs **see also Acromegaly**

Gomphosis (*GOM-foh-sis*) jt b/n the roots of the teeth & the jaw bones **pl – gomphoses**

Gout (*gowt*) initially a metabolic disorder – accumulation of uric acid crystals in one or several jts – later leading to an arthritis & jt degeneration

Granulocytes cells with granules 2 types in the BS / Immune system - WBCs with granules **see Neutrophils**

Granuloma (*Gran-YOU-low-mah*) a smooth jelly orange-yellow papule nodule which microscopically appears as an aggregation of MNCs; a collection of modified macrophages – epitheloid cells, histiocytes surrounded by lymphocytes ± GCs & fibrocytes – attempting to wall off the area from the surrounding T, a granuloma is a feature of Clf **see also Granulomatosis**

Granulomatosis – the process of forming granulomae a response in Clf when there is no resolution of the process.

Groove long pit or furrow

Ground substance AKA Extrafibrillar matrix – refers to the material in T which is not fibrous or cellular & found outside the cells – v prominent in all CTs.

Growth factors natural substances produced by the body or obtained from food that promote growth & development by directing cell maturation & differentiation and by mediating maintenance & repair of Ts.

H

Haemarthrosis blood in the jt cavity

haemo (*HEEM-oh*) **AS hemo-** referring to blood

Hallux the big toe = the first toe

Hamus a hook hence the term used for bones which “hook around other bones or where other structures are able to attach by hooking - hamulus = a small hook.

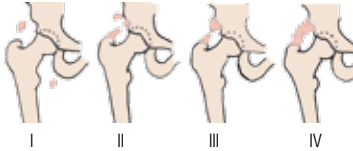
Harris lines AKA growth arrest lines lines of ↑ bone density due to pathological assault or sudden growth spurts. They indicate the position of the EP at the time of the event but they may change the shape of the bone & affect its length. Only seen in Xrays



Haversian canals = osteons *see Osteons*

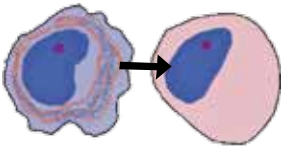
Heberden's nodes OA of the DIP of the hand resulting in swellings & deformities of the jt

Heterotopic ossification formation of bone outside the skeleton – occurs around jt replacement – partic the hip, #s & after paralysis, ectopic bone forms & immobilizes the jt – graded by the amount of movement limitation, progresses until the jt is immobilized - Grade IV no mobility.



Hinge joint jt with movement in one plane e.g. elbow or knee

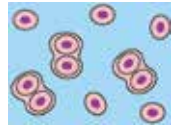
Histamine vasoactive amine stored in mast-cell granules – basophilic histiocytes histio-/hist-/histeo **Gk histos = web** tissues



Histiocyte (*hist-EE-oh-site*) **Gk histio- tissue = phagocytic tissue cell** a cell in the tissues which is immunologically active, derived from the BM mononuclear line. In Clf they may undergo epithelioid transformation *see also Granulomatosis*

Hormone **Gk hormaen = to spur on** a substance secreted in the body having a regulatory affect on organs & Ts

Hyaline **Gk – glassy** smooth glassy generally refers to hyaline cartilage found on the surface of synovial jts to facilitate movement of the 2 bones over each other; but may indicate T changes in which the T takes on a glassy – hyaline appearance



Hydroxyapatite = Hydroxylapatite, (HA) = **bone mineral**, is a naturally occurring mineral form of calcium apatite $\text{Ca}_5(\text{PO}_4)_3(\text{OH})$, but is usually written $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ to denote there are 2 entities. The OH^- can be replaced by: carbonate, chloride or fluoride as in fluoridated water. Up to 50% of bone by weight is a modified form of hydroxylapatite.

Hyoid U-shaped

Hyperostosis abnormal bone growth, thickening, generally overgrowth or ectopic growth

Hyperthyroidism condition of an overactive thyroid gland which may affect the bone and cause OP *see also Thyroid hormone & Calcitonin*

hypo- underneath / below

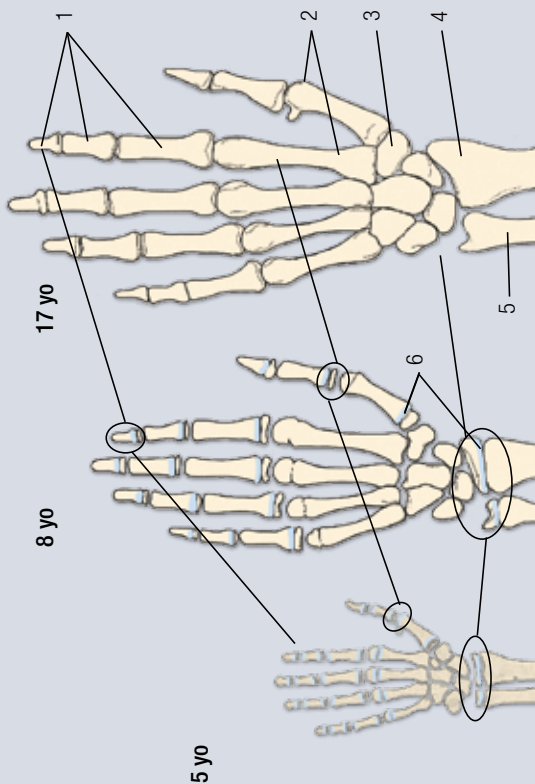
Hypoxia (*Hy- poks-ee-uh*) – lack of Oxygen but not the absence of it \neq anoxia

Ideopathic of unknown origin

Immune (*IM-youn*) **Lt – immunis = to free, to exempt** free from the possibility of acquiring a certain disease or infection

Immune Complexes Ab/Ag combinations used to stimulate the IR

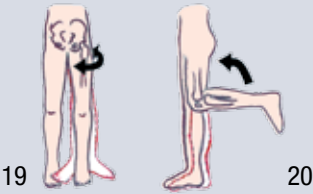
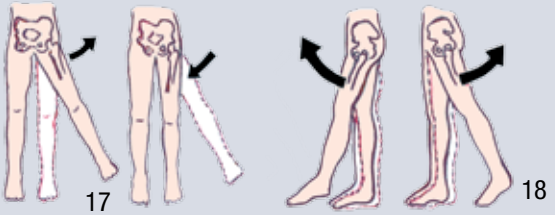
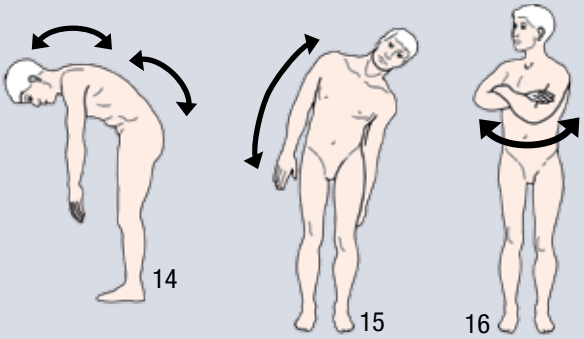
Immune response (IR) any response made by an organism to defend itself against pathogens.



Summary of Joint movements – cephalo-caudally (head to toe)

Lower body

Location	Degrees of movement	Summary – Main screening tests	
Thoraco-Lumbar spine			
Flexion – lumbar / thoracic	60 / 45		14
Lat flexion – R+L	30 + 30 = 60		15
Rotation (Thoracic only) R + L	40 + 40 = 80		16
Hip			
abduction / adduction	40 / 25		17
Extension / Flexion	5–20 / 120	limited by abdomen contacting thigh if done with a flexed knee	18
Rotation @ 90° flexion – external/ internal	45		
Rotation in extension – external / internal	45 / 35		19
Knee			
Flexion	135 +	limited by heel contacting buttock	20
Ankle			
Flexion – dorsi/ plantar	15 / 55		21
Foot			
Forefoot pronation/ supination	20 / 35		
Heel eversion / inversion	10 / 20		22
The Big Toe / Great Toe			
IP jt extension / flexion	0 / 60		
MP jt extension / flexion	65/ 40		



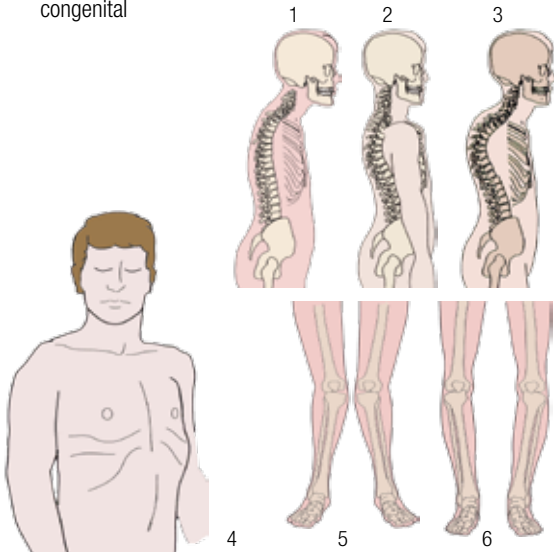
General Principles in the Orthopaedic Examination

INSPECTION

1 Shape / Posture changes

Shape and posture changes (including shortening or uneven limbs) may demonstrate – congenital abnormalities, metabolic disturbances, destructive bone / joint changes with age/time, including incorrect use of the bones as in poor posture, a form of chronic wear & tear trauma, acute trauma or a combination of all these factors.

- 1 poor posture
- 2 round shoulders
- 3 Dowager's hump – gen. developing from OP
- 4 Barrel Chest – gen. due to underlying lung disease
- 5 Valgus = Knock knees – gen. related to metabolic disease / or congenital
- 6 Vargus = Bow legs - gen. related to metabolic disease / or congenital



2 Swelling

Swelling may be confined to a localized region of a bone or joint (as in effusions) as in: infective/inflammatory conditions, neoplastic conditions, traumatic events, or become diffuse.

These conditions may be due to a combination of any of the previously listed aetiologies

- 7 diffuse swelling – gen. an infection over the whole region
- 8 localized swelling – confined to the joint – gen. post-traumatic
- 9 localized swellings – present on the bones not necessarily related to the joint – gen neoplastic
- 10 coloured swellings – as in bruising – gen. post-traumatic or bleeding disorders



3 Wasting

Wasting may indicate disuse, from pain or disuse, 2° to N damage, which may come from neoplasia or trauma.

- 11 muscle wasting in upper leg – asymmetrical disuse

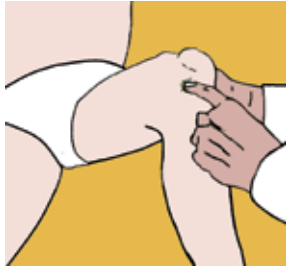


PALPATION

- 1 Heat in the area (which may be observed as a redness) – either localized or diffuse – both often indicate an infective inflammatory process
 - 2 Cold particularly in distal acral regions – may indicate poor BF due to PVD or asymmetrical atherosclerosis
 - 3 Tenderness either local or diffuse usually always indicates an inflammatory process
-
- 11 palpation for heat, maybe over a joint \pm red due to \uparrow BF in the area
 - 12 palpation for tenderness – local or diffuse with swelling may be due to pus or other inflammatory effusion



11



12

MOVEMENT

Nearly all orthopaedic conditions involve at least 1 jt – hence their movements need to be evaluated.

1 Test the Range of Movements (ROM) – normal

active performed by the patient - unassisted

passive performed by the examiner w/o patient input

Generally active ROM < or = passive ROM

This needs to be recorded – ideally with the “Normal” limb – otherwise with ROM tables. “Fixed flexion deformities” – are indicative of contracting joint capsules, muscles, tendons – generally degenerative or infective processes; or of inserted masses in the region either extra-articular – indicative of neoplastic processes, or intra-articular indicative of congenital, degenerative & /or traumatic events.

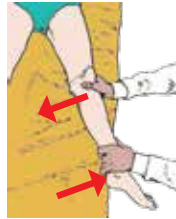
2 Test the Range of Movements (ROM) – abnormal

examiner movement of the limb / jt in abnormal planes

This often indicates, structural changes – possibly due to congenital or degenerative factors

13 measuring the normal ROM of the joint

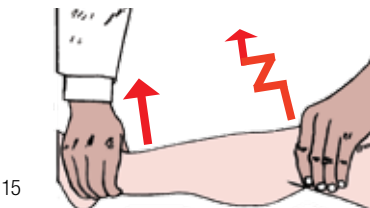
14 examination of movements in abnormal planes



3 Detect any abnormal “clicks” or crepitus on jt movement

if this is extra-articular – it maybe soft tissues moving over the joint – clicks, if this is intra-articular – it may indicate displaced intra-articular bodies – i.e. the meniscus, or irregular joint surfaces 2° to degeneration or acute trauma

15 detection of crepitus – or a grating on movement of the jt



4 Evaluate the strength of contraction over the jt

Although not technically orthopaedic – this measurement not only determines the muscle strength but the health & strength of the underlying jt

In the LL this is particularly relevant and used to assess gait – contraction strength is determined not only by muscle strength/wasting, but by joint pain & innervation.

on the MRC scale – strength of a contraction is scaled as

M0	no active contraction
M1	palpable contraction – but no movement
M2	weak contraction – not strong enough to counter gravity
M3	contraction can overcome gravity
M4	contraction – enables function but is not full strength
M5	full strength

Hence it is also useful to test the sensory levels in the defined region.

MRC sensory scale

S0	absence of all sensory modalities
S1	deep pain sensation
S2	recovery of protective sensation, generalized – heat, pain, touch
S3	recovery of localized sensation / and recognition of objects
S4	normal sensation

16 examination of the sensory modalities



Notes:

The Ankle

Anatomy – simple hinge joint – movements in a single plane plantar / dorsiflexion + axial rotation around the Tibia up to 18° (eversion / inversion)

Weight load – through the Tibia & Talus

Stability – ++++++

A/P – curved tibial bony prominences & lig + weight bearing forces.

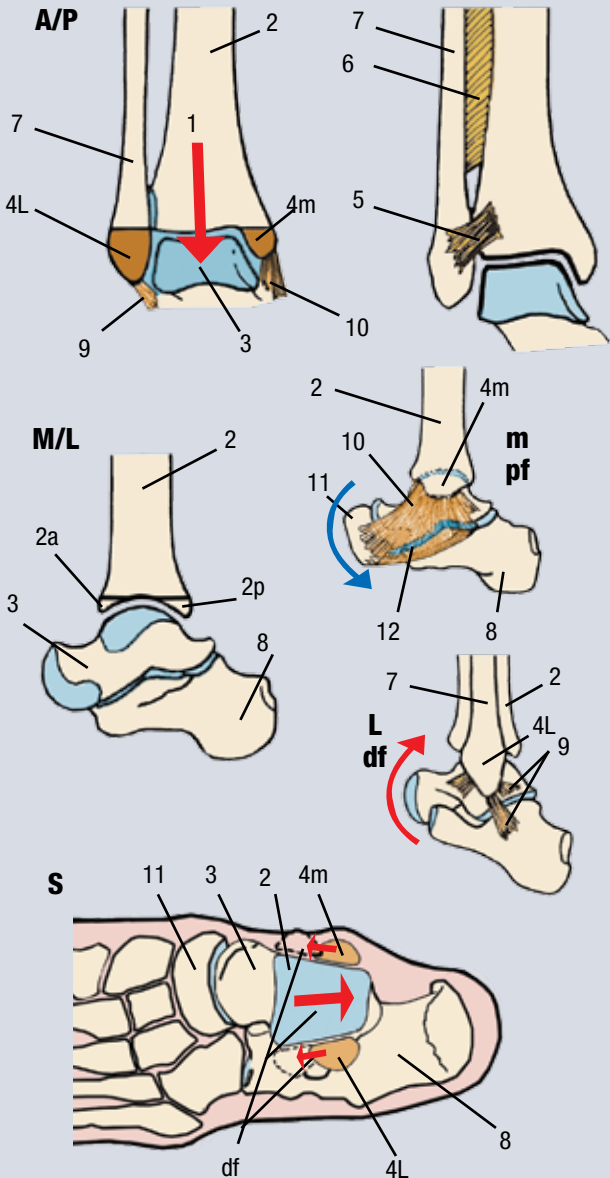
M/L – medial (tibial) & lateral (fibular) malleoli & lig. includ. tibiofibular lig. which bind the Fibula & Tibia together*

S – superior view. When the foot dorsiflexes (df) the Talus moves backwards (see red arrows) so the wider anterior surface fits b/n the malleoli and the jt becomes more secure – the opposite is true of plantar flexion (pf)

Fractures/tears to any of these stabilizing structures will result in failure of the ankle joint

- 1 weight load –load bearing forces in standing
- 2 Tibia – articular projections from the articular surface
a = ant / p = post
- 3 Talus
- 4 malleolus m= medial L = lateral
- 5 inf. tibiofibular lig (ant & post)
- 6 interosseus lig
- 7 Fibula
- 8 Calcaneus
- 9 lateral lig – 3 parts = External lig
- 10 medial lig = Deltoid lig
- 11 Navicular
- 12 Spring lig

* More details of the structure of the ankle can be found in **The A to Z of the bones joints & ligaments and the Back**



The Foot

Anatomy – *The foot acts as a tripod with the force direction from the Tibia going through to the triangular base - of the 1st (1) & 5th (5) MTs & the Calcaneus(2). It moves in 3 axes – X, Y & Z which use the many jts in the foot to facilitate this. Flexion & Extension in the X axis allows the foot to accommodate slopes; Abduction & adduction or turning out & in the Y axis with the feet is limited and mainly in the midtarsal jt (3) in the Y axis and Inversion & Eversion in the Z axis which allows for balance in uneven surfaces is mainly in the subtalar jt (4).*

Stability – ++++++

Good with the many interlocking bone surfaces and limited range of movement along with the broad base of the foot

XYZ tripod of the foot schema

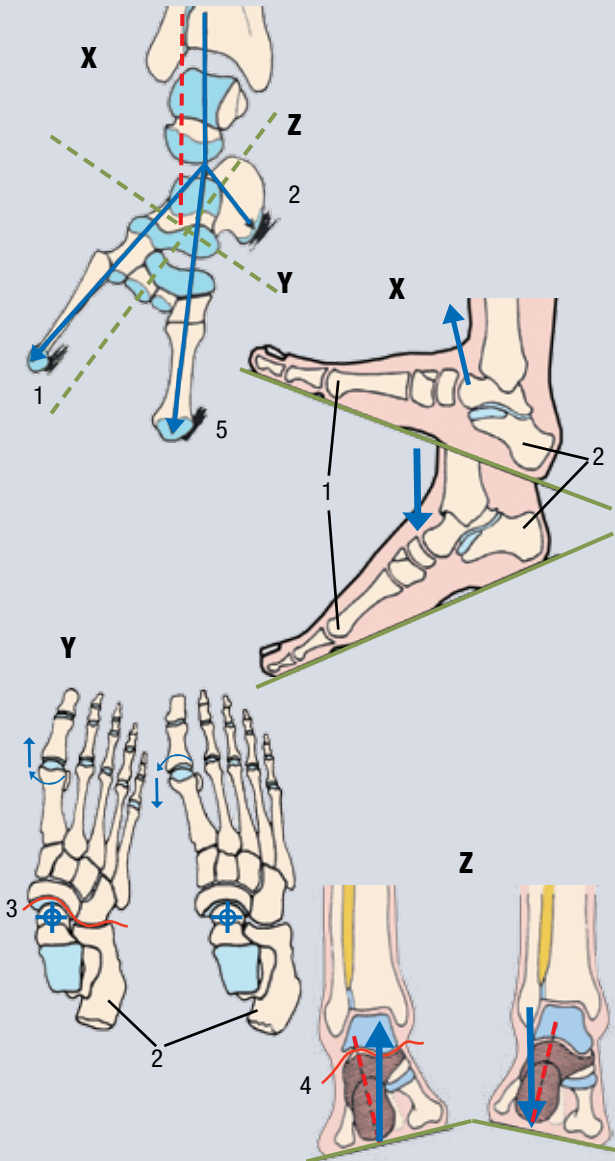
X movements in the X plane

Y movements in the Y axis

Z movements in the Z axis

- 1 1st metatarsal bone
- 2 Calcaneus
- 3 midtarsal jt
- 4 subtalar jt
- 5 5th metatarsal bone

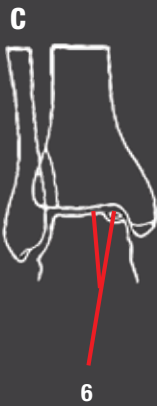
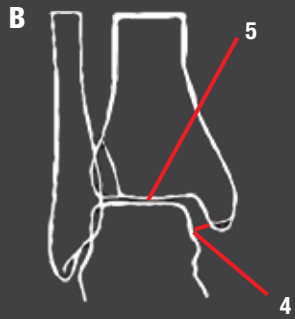
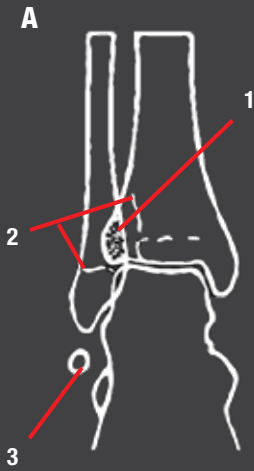
* More details of the structure of the foot can be found in **The A to Z of the bones joints & ligaments and the Back**



The Ankle – Radiological features

Schema A/P

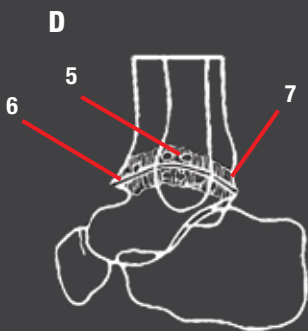
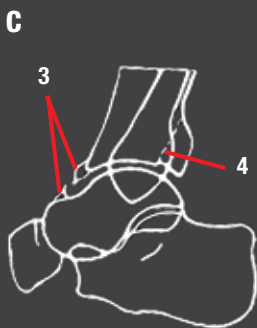
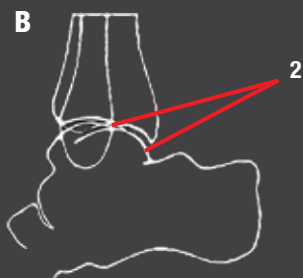
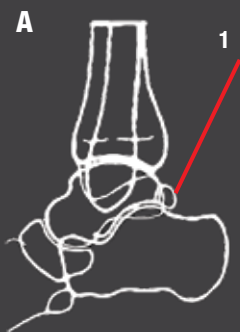
- A** the amount of tibiofibular overlap (1) can be used to determine the extent of diastasis, while the EP (2) should not be mistaken for a Hx of #, although the small “os fibulae” (3) can be a sign of lig &/or bone avulsion & ankle instability.
- B** if the gap b/n the medial malleous & the Talus (4) > the gap of the Tibia & Talus (5) it also indicates diastasis & ankle instability
- C** the presence of any defects or foreign bodies on the articular surfaces (6) indicate arthropathy – osteochondritis tali is the commonest seen in the ankle
- D** note any deformaties on the bony points indicating past avulsions (7)
- E** congenital deformities show up as gross deformities of the bone shape (8) – generally with a compensatory in bone density



The Ankle – Radiological features

Schema – Lateral views

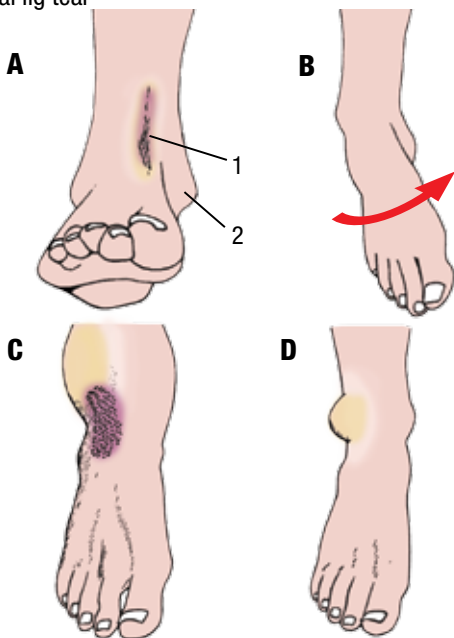
- A** the small os trigonum (1) is a normal bony feature of the ankle not a sign of previous avulsion.
- B** if the gap b/n the talar & tibial articular surfaces (2) are not circular & parallel even with careful positioning then there is subluxation & surface irregularities which may indicate arthropathy
- C** anterior exostoses (3) on the Talus or Tibia are signs of stress anteriorly as in football kicking – posteriorly there may be alterations in the articular line (4) representing #s
- D** generalized exostoses (5) & osteophytes (6) present around the joint indicate arthritic changes – along with narrowing and fuzziness of the joint line (7)



The Ankle – Inspection

Anterior

- A** Scars & deformities – These may be due to previous operations – i.e. sinus drainage (1) or past fractures (2)
- B** Posture deformities – plantar flexion – These may indicate shortened or ruptured tendons, partic the Achilles tendon or bone deformities generally congenital – Talipes deformity
- C** Bruising & Swelling – Note if the swelling – oedema is uni or bilateral (indication of systemic disease), local or generalized
- D** lateral egg-shaped lateral swelling – If this appears quickly – and is hard lateral and local – it indicates lateral lig tear



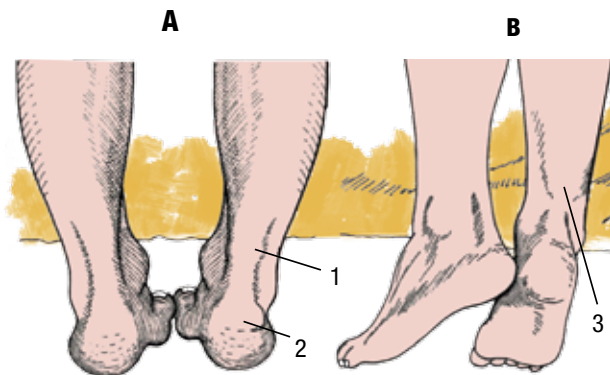
The Ankle – Inspection

Posterior

It is not possible to see a lot of the bony features from behind in the ankle because of the Achilles tendon tends to cover most of them. This is the longest (16cm) & strongest tendon in the body, essential to the functioning of the joint.

The best method to examine posterior ankle joint is to lay the patient prone on the bench & have the feet extended over the edge, comparing the normal side contour with the abnormal side.

- A** upper limb NAD / lower limb shows localized swelling (1) & an exostosis (2) of the Calcaneus – (Hagland's deformity) often associated with tendinitis of the Achilles tendon.
- B** in Achilles tendon rupture the tendon contour is obviously disturbed (3)



The Foot

The Big Toe – Toes Inspection

Toes show a number of deformities generally more exaggerated on the big toe but most occur in any 1 or more toes –

Hallux Rigidus = OA of the 1st MTP of the big toe will show up with thickening of the jt (1) or a fixed flexion deformity (2) with a bunion due to poor foot posture on the sole (7). This is a common site for gout and other articulate arthropathies.

Claw toes if generalized indicate a primary neuromuscular problem or local intrinsic muscle problem – extended forefoot (8) with a fixed flexion of the IP jts (9)

Corns hard on the external surfaces (10) or soft (11) when b/n toes can occur anywhere distinguished from bunions in that they do not occur at pressure sites

Hammer toes – have fixed flexed PIP jts (12)

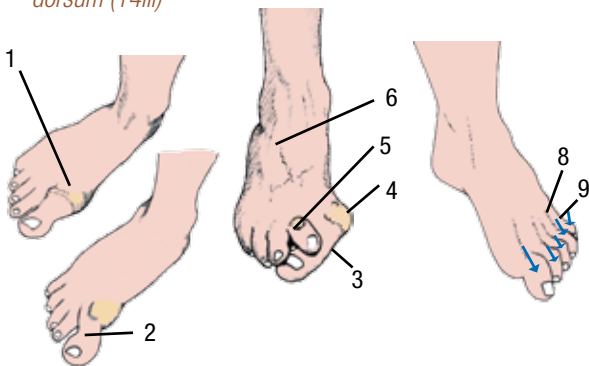
Mallet toes – have fixed flexed DIP jts (13)

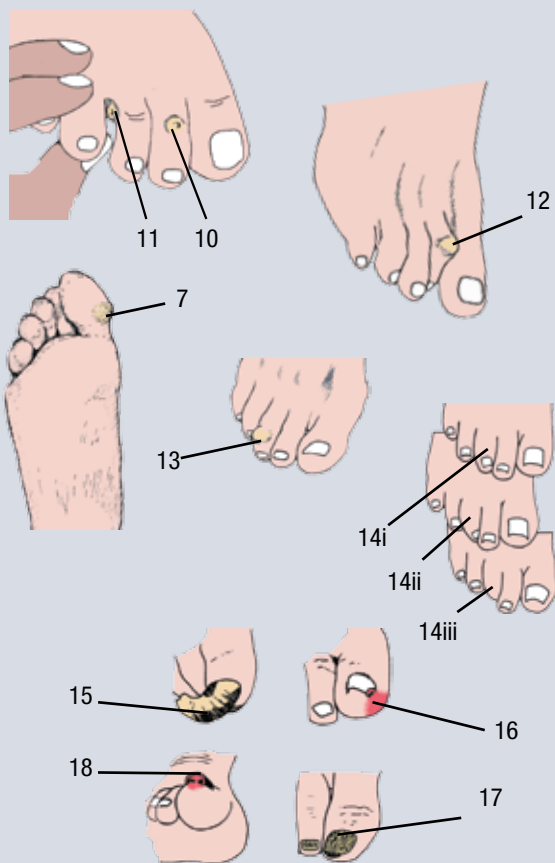
Curly toes – are due to a form of fixed flexion in the IP & MTP jts (14)

grade 1 – mild (14i)

grade 2 – showing some over or under-riding (14ii)

grade 3 – severe – concealing all of the nail from the dorsum (14iii)





Toe nails may be painful for several reasons associated with inflammation, malformation and trauma.

deformed toenail = onychogryphosis (15)

ingrown toenail (16)

texture roughened (17)

elevated – due to subungual exostoses (18)