

1

Directional and Anatomical Terms

Clinical Case: Georgia, a 5-Year-Old Female Spayed Domestic Short Hair

A veterinary technician is assisting a doctor with an appointment. While handling the patient, the technician notices a lump on the patient's hind leg, as shown in Figure 1.1. While reading this chapter, think about the appropriate terminology that should be noted in the patient record for an accurate description of the mass.

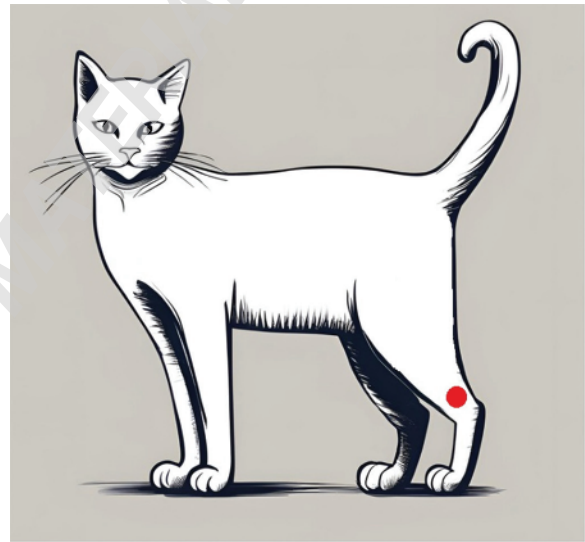


Figure 1.1 Our clinical case with the area of concern noted in red on the hind limb.

Introduction

The study of anatomy is, put simply, the study of the structure of organisms. It involves looking at architecture, at the different positions, shapes, and sizes of various living tissues. As one might imagine, the anatomy of different species has some things in common and some things that are quite diverse. The structure of the heart is very similar in dogs and cats; it is quite different in equines and reptiles. The kidneys of the dolphin look very different from those of the dog, although they function in the same way. By understanding the differences in anatomy among animals, we can have a greater appreciation for how their body systems function. This understanding is the basis of recognizing states of health and disease.

There are a number of different ways to organize how one looks at anatomy. Gross anatomy refers to features that can be seen with the naked eye. Developmental anatomy is the study of how anatomy changes as the fetus becomes a puppy or a kitten. Topographic anatomy refers to the relation to the parts of the whole (e.g., how the different parts of the kidneys and the connecting conduits make up the urinary system). Regional anatomy refers to the structures of a given area of the body; if one looks at the head, for example, as one unit, it will involve the study of all the muscles, blood vessels, bones, and other tissues that are present. Imaging anatomy refers to the anatomical features as they are seen on a good radiograph.

Applied anatomy refers to the anatomy that is most important surgically or for medical treatment. In planning orthopedic surgery, for instance, it is necessary to know not only the structure of the bones but also the local muscles and blood vessels. Most of us use a systems approach when learning anatomy. For example, we study all the bones in the skeletal system, all the muscles in the muscular system, or all the organs in the urinary system.

One of the most important issues in studying anatomy is the understanding of directional terms. If one is asked to find a particular spot on an animal, describing it as “on the leg” is not precise enough. Describing a location using appropriate directional terms makes this much clearer. While the acquisition of vocabulary can be tedious, it is integral to effectively communicate with our clients, veterinarians, and other members of the patient-care team as well as keep accurate medical records. In other words, good anatomic vocabulary contributes to excellent patient care.

Directional Terms

Directional terms in veterinary medicine are very different from those used in human medicine. The human head is “up” from the hips, while it is “forward” in the dog. This is another reason why it is important to use the proper terms. It is also important to understand that many of these terms are used while referring to, or in relation to, anatomical landmarks to make the description clear. This is the same as when one is giving directions for travel. We don’t say, “The store is far away on Main Street.” We say, “The store is on Main Street, in between avenue A and avenue B, across from the diner.” This tells us exactly where the store is using landmarks around it; in the same way, we use anatomical directional terms to be specific about which body part we are discussing.

Anatomical terminology has many unique terms, prefixes, and suffixes which are derived from Latin and Ancient Greek. As such, these terms for direction can correlate to the terms for the location on the body. Going toward the head is **cranial** or moving cranially, referring to the cranium or skull. Going in the opposite direction, toward the tail, is **caudal** or moving caudally, from the Latin word “caud” meaning tail. Going toward the top of the animal that faces the ceiling is moving in a **dorsal** direction, referring to moving toward the dorsum or “back/spine.” From the top downward is moving in a **ventral** direction referring to the ventrum or ground-facing side of the animal from the Latin term for “belly.” Moving toward the center or midline of the animal or a specific limb is considered **medial**, while moving from the midline toward the side of the animal is **lateral**.

On the appendages, such as the limbs and tail, or even pinna (ear flaps), we use some special terms. Closer to the body on the appendage is **proximal**, while moving away from the body on the appendage is moving in a **distal** direction (Figure 1.2). For example, the elbow is proximal (nearer to the body) than the **carpus** (wrist). Alternately, you could say the carpus is distal (further from the body) to the elbow. When using these terms to describe a lesion, mass, or injury, we could say, “There is an approximately 6 cm wound immediately distal to the **lateral** elbow on the right forelimb” (Figure 1.3). This tells us the size of the wound, that it is just below (or farther away from) the elbow on the lateral (outer facing) side of the animal on the right leg. Being described in such a way leaves no room for error when communicating with anyone on the patient care team or in written records.

There are other specialized terms used for direction on the limbs and head. Previously, we discussed that the term cranial was moving toward the head, but once we reach the head, a different term is used: **rostral**. Rostral is used in the place of cranial only on the head and means toward the nose, derived from Middle English and Old French to mean the “bony beak.” The term rostral remains paired with caudal as its opposite on the head. As an example, one could say “The nose is rostral to the eyes” or “The ears are caudal to the nose” (Figure 1.3).

Additional Terminology

Features of the limbs also get special names. The front legs are referred to as the **thoracic limbs**, while the rear legs as the **pelvic limbs**. The shoulder and elbow in dogs are, in medical terms, the **scapulohumeral** and **humeroradioulnar** joints, respectively, although they are commonly referred to as shoulder and elbow in discussions with clients and others on the patient care team. The next joint distal to the elbow is the carpus, which is the equivalent of the human wrist. On the pelvic limb, the joint between the femur and tibia is the **femorotibial joint**, commonly known as the **stifle**, which is equivalent to the human knee. The next joint going distally is the **tarsus**. The common name for the tarsus is the **hock**, a term generally reserved for large animals, all of which is equivalent to the human ankle.

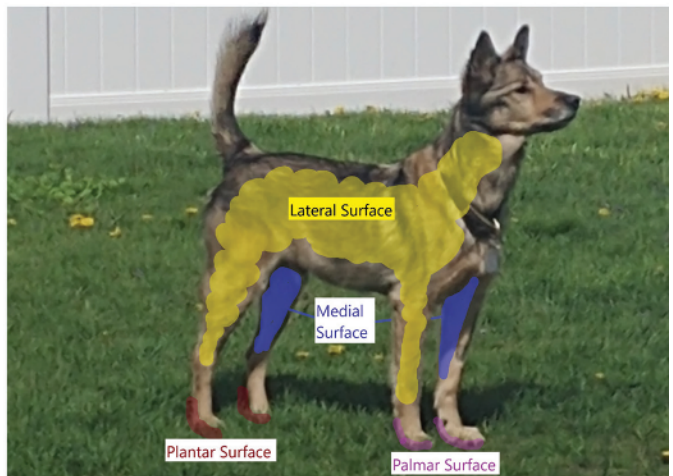
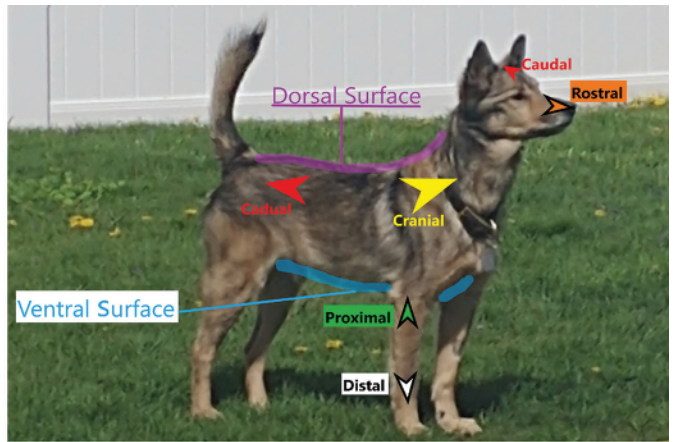
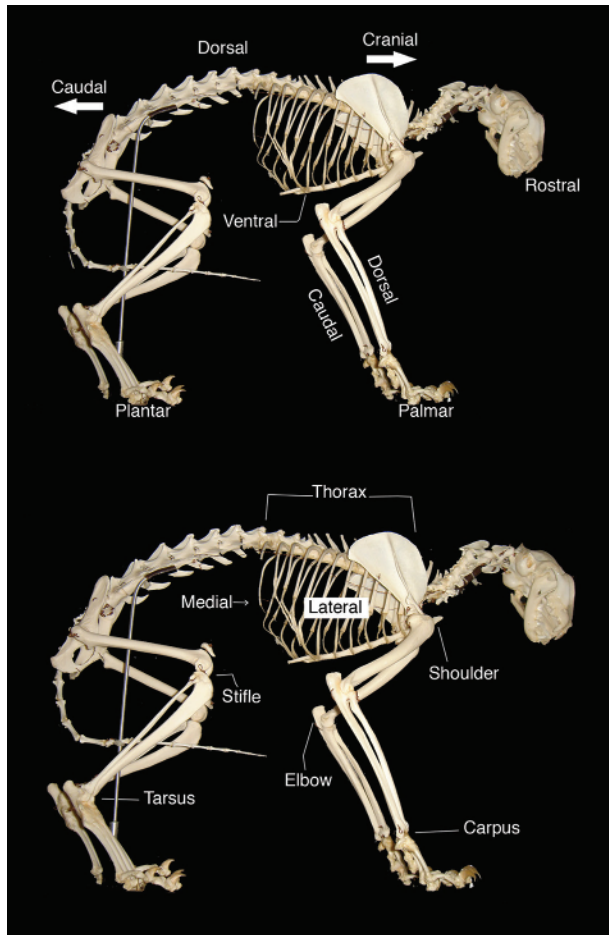
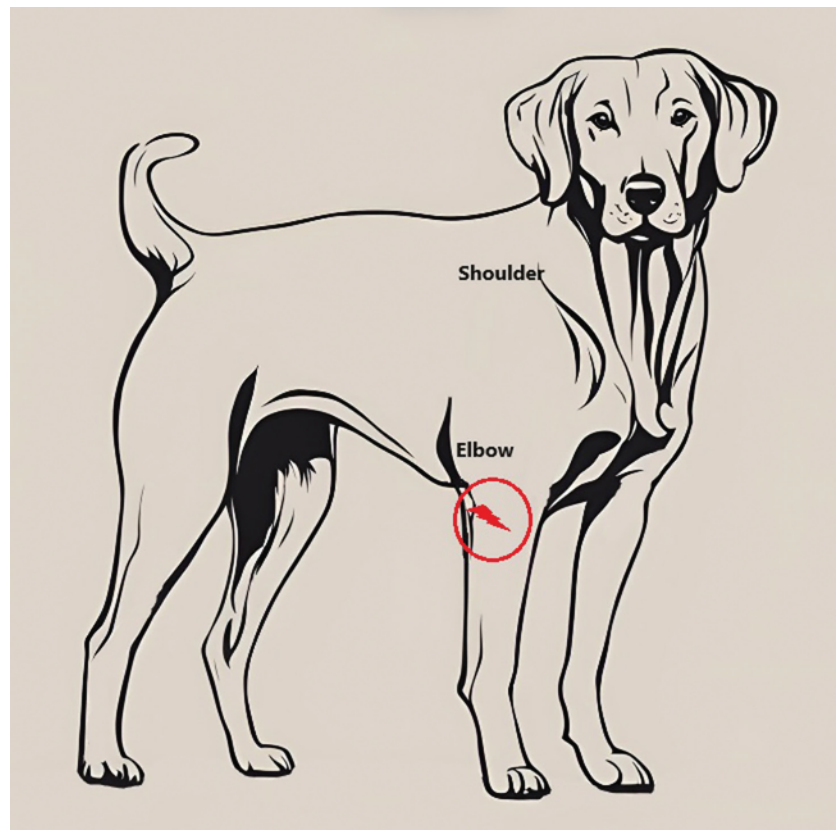


Figure 1.2 Directional terms as they pertain to the feline/canine skeleton. Also noted are some of the major joints.

Figure 1.3 A laceration is noted on this patient, described as “an approximately 6 cm wound immediately distal to the lateral elbow on the right forelimb.” Note the importance of directional and location terms.



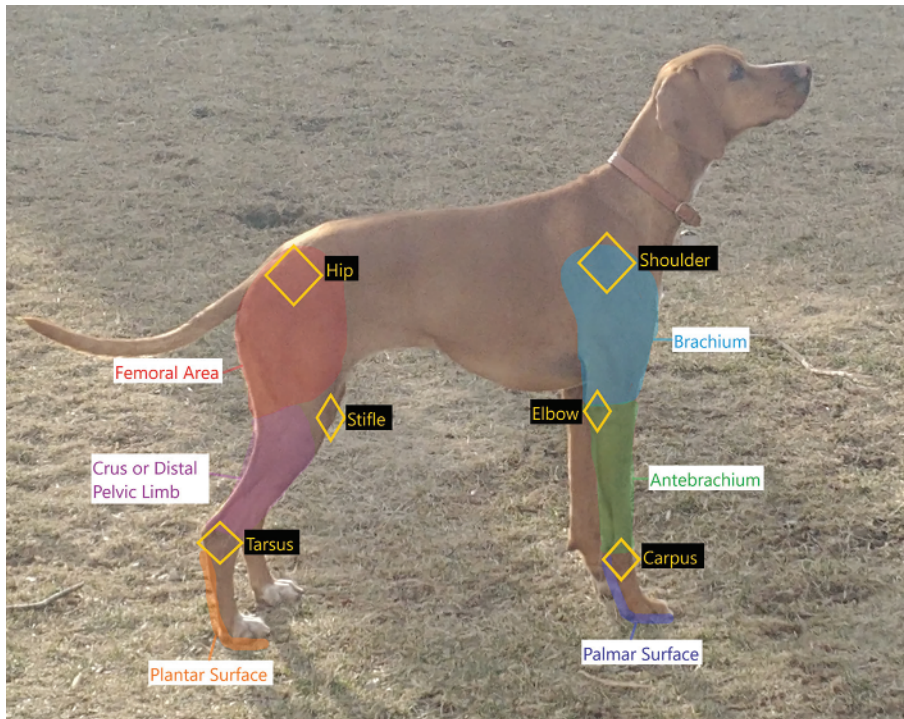


Figure 1.4 The different sections of the thoracic and pelvic limbs with the plantar and palmar surfaces noted.

The part of the thoracic limb from the shoulder to the elbow is referred to as the **brachium**; the area from the elbow to the carpus is referred to as the **antebrachium**. The area from the head of the femur (the proximal-most bone of the pelvic limb) to the stifle is called the **femoral area**. The area from the stifle to the tarsus is technically called the **crus**, although this term is not commonly used in a clinical setting; the distal pelvic limb is less precise but often used in general practice (Figure 1.4).

When considering the trunk, we have used terms like caudal, dorsal, and ventral. These terms also apply to the limbs. The front of the leg from the shoulder going distally to the paw is the dorsal section, with the back of that same area as the caudal section. On the thoracic limb, the area from the carpus distally, on the caudal surface, and around to and including the ventral surface of the paw that meets the ground is known as the **palmar surface**. On the pelvic limb, the analogous area from the tarsus to the bottom of the paw is the **plantar surface** (Figure 1.4).

There are specific names for other parts of the body. The part of the body that includes the chest and abdomen is referred to as the **trunk**. As discussed earlier, the proper name for the ventral part of the abdomen is the **ventrum**, while the proper name for the top of the trunk is the **dorsum**. The lateral surface of the part of the trunk caudal to the chest is the **flank**.

The part of the trunk from the neck to the caudal ribs is referred to as the **thorax**. The **abdomen** refers both to the outer surface (the skin) of the ventrum and to the space within it, extending from the caudal ribs to the pelvis. The space within the thorax is called the **thoracic cavity**, and the space within the abdomen is called the **abdominal cavity**. Note, however, that some of the features of each of these cavities are lined by a membrane. The **pleural membrane**, within the thorax, surrounds the lungs and lines the walls of the thoracic cavity. The area bordered by this membrane is considered to be within the **pleural cavity**. Similarly, the membrane surrounding some of the organs and lining the interior walls of the abdomen is called the **peritoneal membrane**, or **peritoneum**, and that space is called the **peritoneal cavity**. These cavities and tissues will be discussed again throughout the anatomy and physiology chapters of this text where relevant.

Along with directional and basic anatomical terminology, which allows us to accurately describe the location we desire, we also need to understand the medical language used to discuss these features. Veterinary medical terminology, like any other medical terminology, is a language in and of itself. It is based on a series of prefixes, suffixes, and root words that allow for endless combinations in an effort to accurately describe physiological processes, anatomical parts, diseases, syndromes, and a myriad of other things in medicine. Please refer to Tables 1.1–1.3 for the most common list of these terms along with examples of their use.

Table 1.1 Prefixes.

Term	Referring to	Example
a/an-	without, not	Anemia – without blood – refers to a low red blood cell count
ab	away from	Abductor – muscle(s) that moves the limb away from the body
ad	toward	Adductor – muscle(s) that move the limb toward the body
ante-	before, in front of	Antebrachium – before the brachium (lower portion of the limb)
anti-	against	Antibacterial – an agent (drug, cleanser etc.) against bacteria
auto-	self	Autoantibodies – antibodies against one's own tissues
brady-	slow	Bradycardia – slow heartbeat
bi-	two	Bilateral – both/two sides
bucco-	cheek	Buccal pouch – space in between cheek and gums – used for medicine administration
circum-	around or surrounding	Circumduct – moving a limb around in a circular way
crypto-	hidden	Cryptorchidism – one or both testicles are undescended and remain in the abdominal cavity
cyan-	blue	Cyanosis – mucous membranes or skin appearing blue due to lack of oxygen
cyt-	cell	Cytology – study of cells
dis-	apart, away	Dissect – cut apart
dys-	abnormal, bad	Dysplasia – abnormal growth
ex/exo-	out of, outside, external	Exoskeleton – an outer covering in invertebrates analogous to mammalian skeleton
endo-	inside	Endoscopy – to look or examine inside with a specialized tool
epi-	upon, on	Epiglottis – the covering on the trachea
erythr/o-	red	Erythrocyte – red blood cell
eu-	good	Eupneic – breathing well/normally. Euthanasia – good death
extra-	beyond, outside of	Extraocular – just outside the eye
hemi-	one half	Hemiplegia – paralysis of one side of the body
hetero-	different	Heterozygous – two different forms of one gene
home/o-	same	Homeostasis – a steady, balanced state maintained by living things
hyper-	excess, too much	Hyperthermia – too high of body temperature; febrile
hypo-	below, under, too little	Hypothermia – too low of body temperature
infra-	beneath	Infraorbital – beneath the bony orbit of the eye
inter-	between	Interdigital – in between the digits of the paw or hoof
intra-	inside, within	Intraocular – within the eye
iso-	equal, like	Isosthenuria – urine with the same concentration of protein-free plasma
leuk/o-	white	Leukocyte – white blood cell
lith-	stone	Lithotripsy – a procedure using sound waves to break up stones in the body
macro-	large, long	Macrophage – a type of large white blood cell
melan/o-	black	Melanocyte – a pigment-producing cell
meso-	middle	Mesoderm – the middle layer in a developing embryo
meta-	beyond	Metacarpus – the bones beyond the carpus
micro-	small, minute	Microhepatica – small liver
myo-	muscle	Myocardium – the muscle layer of the heart
necro-	death	Necrosis – tissue death
neo-	new	Neonate – newborn
pan-	everything, all	Panzootic – involving all animals

(Continued)

Table 1.1 (Continued)

Term	Referring to	Example
para-	next to, alongside	Parathyroid – an organ alongside the thyroid gland
peri-	around, enclosing	Pericardium – the tissue around the heart
poly-	many, multiple	Polydactyl – multiple (excessive) digits
post-	after	Postrenal – after the kidneys, referring to illness
pre-	before	Prerenal – before the kidneys, referring to illness
pseudo-	false	Pseudopregnancy – false pregnancy
re-	again, backward	Reflux – return of fluid backward from it should be – acid reflux from the stomach into the esophagus
retro-	backward, behind	Retropharyngeal space – area behind the pharynx
semi-	partially, half	Semilunar – half-moon shaped, referring to the cardiac valves
sub-	below, under	Sublingual – under the tongue. Subcutaneous – under the skin
supra-	above, over	Suprarenal – above the kidney
sy/syl/sym-	together, joined	Symphysis – a joint where two bones come together; pubic symphysis or mandibular symphysis
trans-	across, over	Transection – to cut across something
tachy-	rapid, swift	Tachycardia – fast heart rate
ultra-	extremely, beyond	Ultrasound – sounds beyond the limit we can hear; sound technology used for imaging

Table 1.2 Suffixes.

Term	Referring to	Example
-ac	pertaining to	Cardiac – pertaining to the heart
-algia	pain	Neuralgia – nerve pain
-ate	having, possessing	Caudate – having a tail
-blast/o/ic	bud, germ	Osteoblast – a cell that builds the matrix for bone
-centesis	puncture	Thoracocentesis – puncturing the thoracic cavity with a needle to remove air or fluid
-cyte	cell	Leukocyte – white blood cell
-cytosis	referring to cells, many	Leukocytosis – too many white blood cells
-ectomy	excision, removal	Orchiectomy – surgical removal of the testicles
-emesis	vomiting	Hematemesis – vomiting blood
-emia	blood, in the blood	Hyperphosphatemia – excess phosphorus in the blood
-genesis	origin, beginning of	Pathogenesis – the origin and development of the problem
-gram	drawn, written	Electrocardiogram – a graph of the heart's electrical function on the surface of the skin
-graph	to write	Electrocardiograph – the machine that creates the graph for the electrocardiogram
-ia	condition of	Hyperglycemia – the condition of having too much sugar in the blood
-iasis/osis/sis	condition of	Trichiasis – condition of having hair grow in the wrong direction (eyelash)
-ism	condition of	Hyperthyroidism – condition of having an overactive thyroid gland
-itis	inflammation of	Sinusitis – inflammation of the sinuses
-lith	stone	Cystolith – bladder stone
-logy	study of	Osteology – the study of bones
-lysis	break down, destruction	Hemolysis – destruction of red blood cells
-megaly	enlargement	Splenomegaly – an enlarged spleen

Table 1.2 (Continued)

Term	Referring to	Example
-meter	measuring device	Sphygmomanometer – a manual blood pressure measuring device
-oid	resembling, like	Fibroid – having a fibrous-like appearance
-oma	tumor, cancer	Lipoma – fatty tumor; carcinoma – a malignant tumor of epithelial cells
-ostomy	opening	Tracheostomy – an opening in the trachea, usually to help breathing
-otomy	incision	Laparotomy – an incision made into the abdominal wall/cavity
-pathy	disease	Enteropathy – disease of the small intestine
-penia	lack of, deficiency	Lymphopenia – deficiency of lymphocytes
-pexy	fixation	Gastropexy – surgically fixating the stomach to the body wall
-phagia/phagy	eating	Dysphagia – difficulty eating; polyphagia – eating too much
-plasia	growth, formation	Neoplasia – new growth, generally referring to a tumor
-plasty	surgical reconstruction	Episioplasty/Vulvoplasty – surgery to reconstruct the vulva
-plegia	paralysis	Hemiplegia – paralysis of one side of the body
-pnea	breath, respiration	Dyspnea – abnormal breathing
-rrhea	flow or discharge	Diarrhea – flowing watery feces
-rrhexis	rupture	Enterorrhexis – rupture of the intestine
-scopy	to examine with a tool	Gastroscoy – to look or examine inside the stomach with a specialized tool
-stasis	level, unchanging	Homeostasis – a steady, balanced state, maintained by living things
-stomy	creating an opening	Colostomy – a surgical hole in the colon for waste removal
-tomy	incising	Tracheotomy – cutting into the trachea
-tome	cutting instrument	Osteotome – a bone-cutting instrument
-trophy	growth	Hypertrophy – increased size or growth of tissue
-uria	presence in urine	Hematuria – presence of blood in the urine

Table 1.3 Root words.

Term	Referring to	Example
abdomin/o	abdomen	Abdominocentesis – puncturing (with a needle) into the abdominal cavity to remove fluid
aden/o	gland	Adenoma – a benign tumor of a gland
adip/o	fat	Adipose tissue – fatty tissue
arter/o	artery	Arteriole – a small artery
brachi	arm	Brachium – the upper portion of the forelimb. Antebrachium – the lower portion of the forelimb
brachy	short	Brachycephalic – shorter than the average skull length (example: English Bulldog, Pug)
bronch/o	bronchus	Bronchoscopy – using a special tool to see inside the bronchi/ main branches in the lungs
carcin/o	cancer	Carcinoma – cancer of the epithelial tissue, possible in many organ systems
cardi/o	heart	Cardiomegaly – an enlarged heart
carp/o	wrist	Metacarpus – the bones between the wrist and phalanges
cephal/o	head	Mesocephalic – an average- or medium-sized skull length (example: Labrador Retriever)
cerebell/o	cerebellum	Cerebellar hypoplasia – a disease in which the cerebellum fails to grow properly <i>in utero</i>
cerebr/o	brain, cerebrum	Cerebrospinal fluid – fluid that surrounds the entire brain and spinal cord
col/o	colon/large intestine	Colectomy – surgical removal of a part or all of the colon

(Continued)

Table 1.3 (Continued)

Term	Referring to	Example
cyt/o	cell	Cytotoxin – an agent toxic to living cells
cyst	pouch, bladder	Cystitis – an inflammation of the urinary bladder (“cyst” can refer to the gallbladder as well)
dactyl	digit	Polydactyl – a condition of too many digits per paw
derm/a/o	skin	Dermatology a branch of medicine focusing on the skin and integument
dextr/o	right side	Oculus Dexter (abbrev: OD) – right eye
dolich/o	long, narrow	Dolichocephalic – a longer than average skull length (example: Greyhound, Borzoi)
duct/o	to lead, to carry	Abduction – to lead the limb away from the body
encephala/o	brain	Encephalopathy – any disease or disorder of the brain
enter/o	intestine/small intestine	Gastroenteritis – an inflammation of the stomach and small intestine
esthes/o	nerve sensations	Feline hyperesthesia – a condition in which the patient is extremely sensitive to touch
gastr/o	stomach	Gastrotomy – a surgical incision into the stomach
gingiv/o	gum	Gingivitis – inflammation of the gums
gloss/o	tongue	Glossopharyngeal nerve – a cranial nerve that helps controls tongue movement and more
glyc/gluc/o	(blood) sugar	Hypoglycemia – too low level of sugar in the blood
gnath/o	jaw	Prognathism (mandibular) – a term for an underbite
hemat/o	blood	Hematopoiesis – formation of blood cells
hepat/o	liver	Microhepatica – an abnormally small liver
iatro	medicine, healing	Iatrogenic – illness caused by medical treatment or interventions
ile/o	ileum	Ileocecolic junction – where the ileum, cecum, and colon meet in the digestive tract
jejun/o	jejunum	Jejunostomy tube – a feeding tube placed directly into the jejunum of the small intestine
lingu/o	tongue	Sublingual – under the tongue
mammo/mast	mammary glands	Mastitis – inflammation and infection of the mammary gland(s)
metri/o/a	uterus	Pyometra – pus-filled uterus
nephro	kidney, nephrons	Nephrology – the study of the kidney and its functions
neuro	nerve, nervous system	Neurology – the branch of medicine that deals with the nervous system
ocul/o	relating to the eye, vision	Intraocular pressure – the amount of pressure inside the eye
onych/o	nail, claw	Onychectomy – a removal of the claws; a declaw
ophthalm/o	relating to the eye	Ophthalmoscope – a tool used to look into the eye to view the retina and other structures
orchi/o	testicle	Orchiectomy – removal of the testicle(s); a neuter
oro	mouth	Oropharynx – an area comprised of the mouth and throat
osseo, oste/o	bony	Osteosarcoma – a cancer of the bones
oto	ear	Otitis externa – an inflammation and infection of the outer ear
path	abnormal, disease	Pathology – a branch of medicine focused on the study and diagnosis of diseases
pharyng/o	pharynx	Nasopharyngoscopy – a procedure to look into the back of the nasal passages and throat
phleb/o	vein	Phlebotomy – removal of blood from veins, usually for laboratory testing
pneum/o	air, breathing, lungs	Pneumothorax – air in the thoracic cavity outside of the lungs
pod/o	foot	Pododermatitis – an inflammation and infection of the skin around the toes and foot
poiesis	creation, formation	Erythropoiesis – formation of red blood cells in the body
poikilo	irregular, varied	Poikilocytosis – an increase in abnormally shaped red blood cells
pulmo/n	lungs	Pulmonary thromboembolism – a blood clot that gets stuck in the blood vessels of the lungs
pyelo	renal pelvis	Pyelonephritis – an infection and inflammation of the renal pelvis and kidney

Table 1.3 (Continued)

Term	Referring to	Example
pyo	pus	Pyoderma – a skin infection that forms pus-filled blisters or pustules
ren/o	kidney	Adrenal gland – a gland next to the kidney
rhin/o	nose	Rhinotomy – using a special tool to see into the nasal passages
sinister/o	left side	Auris Sinister (abbrev: AS) – left ear
stoma	mouth, opening	Urethrostomy – an opening made in the urethra to allow urine to pass out of the body
tars/o	ankle or eyelid	Tarsus – the “ankle.” Tarsorrhaphy – partially or completely sewing the eyelids together
therm/o	heat	Hyperthermia – an elevated body temperature
thorac/o	thorax or chest	Thoracotomy – opening the thoracic cavity
trache/o	trachea	Rhinotracheitis – an infectious disease that causes inflammation of the nose and trachea
trich	hair	Trichobezoar – a mass of hair formed in the stomach, a hairball
ure/uro	urine or urea	Uroabdomen – urine freely floating in the abdomen as a result of urinary tract injury
ven	vein	Venule – a small vein

Clinical Case Resolution: Georgia

In the example at the beginning of this chapter, a problem was noted with Georgia’s “hind leg.” This language is not appropriately descriptive for a medical record. Using the terminology learned in this chapter, we should describe this finding as follows: The patient has an approximately 3 cm mass (to describe size) on the left pelvic limb (to describe the side of the patient and limb) proximal to the lateral tarsus (to describe the exact location on the limb).

Review Questions

- 1 Define the terms medial, rostral, and dorsal.
- 2 Which is more cranial, the thoracic limb or the pelvic limb?
- 3 The caudal paw area on the thoracic limb is referred to as the _____ surface.
- 4 True or false: The stifle is caudal to the tail.
- 5 Define the term “topographic anatomy.”
- 6 Go back to the case about Georgia and look at the provided Figure 1.1. Describe the mass that was found in relation to the stifle using appropriate directional and anatomical terms.
- 7 Refer to Figure 1.3 where a laceration was described. Describe the injury in relation to the hip using appropriate directional and anatomical terms.
- 8 Which of the following terms refers to the liver?
 - A Gastric
 - B Hepatic
 - C Pleural
 - D Renal

9 Which of the following terms refers to inflammation?

- A** Sarcoma
- B** Hyperthyroid
- C** Bradycardia
- D** Pancreatitis

10 Which of the following terms refers to muscle?

- A** Leukocyte
- B** Myocardium
- C** Polydactyl
- D** Ultrasound

Extra terminology practice: Use Tables 1.1–1.3 to deduce the meaning of the incorrect answer choices for questions 8, 9, and 10. Example: Gastric – referring to the stomach from the root word “gastr/o.”