|  |  |
| --- | --- |
| Scissors | * Operating scissors: Used to cut only inanimate objects like suture, paper drapes, sponges; can be straight or curved, blades can be sharp tipped or blunt * Mayo scissors: Used to cut large muscle masses, cartilage, and other nondelicate tissue; blades are straight or curved, also thick and 1/3 of the length of the instrument * Metzenbaum scissors: Used for delicate surgical dissection; blades are straight or curved, also thin, delicate, and ¼ of the length of the instrument; shaft is long and thin as well * Iris scissors: Small, fragile; very sharp, pointed tip (eye) * Suture removal scissors: Have one blade in the form of a hook that cradles the suture to be cut (Littauer or Spencer) * Lister bandage scissors |
|  | Hemostats 1   * Halstead mosquito hemostatic forceps: Used to clamp small vessels like skin bleeders; small jaws w fine horizontal serrations that extend the entire length of the tip * Kelly hemostatic forceps: Used for medium vessels or small tissue masses; larger than Halstead w wider horizontal serrations that extend only half the length of the jaw * Crile hemostatic forceps: Kelly w serrations extending the entire length of the jaw; too traumatic to edges of an incision so only used to occlude vessels |
|  | Hemostats 2   * Ferguson angiotribe: Used on vessels and tissue of any size that is not viable in the body (e.g. uterine stump); strong, traumatic w a crushing jaw that has one raised one recessed jaw; not a real hemostat * Rochester-Carmalt hemostatic forceps: Used to clamp large vessels or tissue masses; has both horizontal and vertical serrations near the tip (checkerboard appearance); large—8 inches w jaw taking up 3.5 inches * Rochester-Pean hemostatic forceps: Used to clamp large vessels, muscles, and tissue masses; has horizontal serration through the entire jaw; distinguishable from Crile in its length (length of forceps and jaw similar to carmalt) |
|  | Needle Holders   * Derf: Used in small patients and in extraocular ophthalmic procedures (too large for intraocular surgery) * Olsen-Hegar: Has scissors built into the jaws to allow cutting for the suture w/out using another instrument (time saving) but easy to cut inadvertently * Mayo-Hegar: No cutting surface; available in different lengths |
| Scalpel blades | * No. 10 blade is commonly used for incisions * No. 11 blade has a sharp point for making a small (stab) incision, just large enough for an arthroscope or cannula to enter the joint * No. 12 blade resembles a hook w the cutting edge on the inside curve; frequently used to declaw cats * No. 15 blade has the appearance of a No. 10 blade, but is half the length (width) * Most common handles are Bard-Parker No. 3 for 10 – 15 blades (small animals), and No. 4 for 20 – 23 blades (large animals) |
|  | Thumb forceps   * DeBakey thoracic thumb tissue forceps: Used in thoracic, vascular, neurologic procedures, only on delicate tissue because the tips have no teeth but only a ridge or groove; originally designed as a cardiovascular instrument * Tissue thumb forceps: Straight shaft (5 – 12 inches) w 1x2 or 3x4 teeth * Russian thumb tissue forceps: Used on skin or tissue that is removed; has very traumatic, bulky tip; used on dressings too * Adson thumb tissue forceps: Very narrow tip that broadens to a 0.5 inch shaft; Adson dressing forceps tips have no teeth but have flat atraumatic serrations (used as an aid in placing or removing dressing on wounds), Adson-Brown has two parallel rows of 9 shallow teeth (common general surgery forceps), and Adson 1x2 has one tooth on one tip and 2 on the other, which can be fairly traumatic I used on delicate tissue * Allis tissue forceps: Used to grasp tough (linea alba) tissue (or tissue to be removed) in traumatic ways, which makes it a unique instrument that is neither a forceps or a hemostat; ring-handled w teeth in 3x4 or 4x5 style * Specialty forceps: Satinsky, Cooley, Mixter (90 degree) forceps for thorax |
|  | * Handheld retractors: No ratchet; must be held to be functional * US Army: Double-ended retractor w different lengths of blades on either end; no teeth on blades so little tissue trauma * Senn: Double-ended retractor w a narrow/blunt bladed end and a toothed/traumatic end (teeth are sharp or blunt) * Self-retaining retractors: * Gelpi: Single, sharp tips so fairly traumatic; limited use in soft tissue surgery, mostly used in orthopedic and neuro surgeries * Weitlaner: Teeth in the jaw (blunt or sharp); used in orthopedic surgery w blunt version also used in some soft tissue * Balfour: Common in soft-tissue surgery like abdominal procedures; has two sides for lateral retraction and a third blade for cranial retraction * Finochietto: Used to retract the thoracic wall; small for under 10 kg, large for above * Alms (Andrews-Lucia-McPherson): Very small (eyelids in humans) |
|  | * Backhaus: Penetrating tips; 3.5 or 5.5 inches * Roeder: Balls on the tips prevent clamp from being placed too deeply in the tissue * Jones: Delicate; lightweight, but penetrating; no ratchet and ring handle, but a squeeze handle which makes it convenient on smaller patients * Lorna (Edna): Nonpenetrating so ideal for securing second layer drapes to ground drapes; 3.5 or 5.5 inches |
|  | Other soft tissue instruments:   * Snook spay hook * Dawling spay retractor: Designed to assist solo surgeon in feline and canine spays by isolating the uterine horn for better visualization and stabilization * Needle rack: Spring mounted on a metal based; used to store free needles during autoclaving * Groove director: Aids in making incisions on the linea alba by providing a channel for the scalpel to follow * Doyen and Babcock intestinal clamps/forceps: Both are self-retaining and are used to manipulate intestinal tissue that will remain in the patient (Rochester-Carmalt can be used if tissue will be taken out); Babcock looks a lot like Allis, but don’t have teeth |
|  | Orthopedic surgery instruments:   * Bone holders (bone-holding clamps): Used to hold bone fragments together until permanent fixation; can have pointe, toothed, or serrated tips, and come in different sizes and styles * Periosteal elevators: Used to prepare fractured bone for permanent fixation by elevating the periosteum so that implants can be placed; include Freer, ASIF, Synthes, and Adson elevators * Bone rongeurs (Lempert/Ruskin): Used to remove or break up bits of bone for grafting (pieces that are too small for reattachment are packed around fracture line to encourage new osteoblast formation) * Bone cutters: Have cutting-edged tips to cut and remove small bones; otherwise looks similar to rongeurs * Hand/Jacob’s chuck: Manual drill used to hold and drive intramedullary pins |
|  | Ophthalmic surgery instruments:   * Beaver blade handle: Used to hold Beaver blades required for most intraocular procedures (No. 15 blade w No. 3 handle can be used for some others) * Lid speculum: Barraquer is used for intraocular procedures, a chalazion is used for lid procedures; most helpful to remove tumors * Lacrimal cannulas: Used to flush lacrimal ducts (syringe attached to one end w the blunt or bulb shaped end aiming the duct); straight or curved * Thumb tissue forceps: Iris 1x2 is common * Scissors: Baby Metzenbaum and other miniature versions of general surgery instruments, or specialty ones like Castriviejo, Stevens tenotomy scissors, and iris scissors * Mayo-Hegar or Derf needle holders |
| Emasculator | * Tool used to crush and cut the spermatic cord during large-animal castrations; crushes the spermatic cord to stop blood flow and then performs a sharp cut to sever the cord |
|  | * Taper-point needle has a sharp point that pierces and penetrates tissue w/out leaving small cuts; its round body is good for tissues that need sealed suture line (e.g. intestines, balder, hollow organs)—any tissue that shouldn’t be traumatized * Taper-cut needle combines a round, tapered body w a reverse cutting point (has 3 cutting edges on the point—cross section is triangular w one edge outside the curve); used in tough fibrous tissue and some cardio procedures because it’s stronger * Cutting-edge needle has 3 cutting edges on the point and body, but 3rd is on the inside of the curve; most traumatic because cutting edge on the inside of the curve cuts to the edge of wound (regular cutting least traumatic) * Bodies can be straight (Keith) for anal purse-string sutures, circular, or curved * Ends may have eyes where suture is passed (French eye has two—one for passing suture, other for holding it) or be swaged (eyeless, so most atraumatic); eyed needles can be autoclaved and reused * Size of suture material, type of tissue to be sutured, and its location are all considerations when deciding on what needle to use |
| Suture types:  Monofilament and multifilament sutures | * Monofilament: Single strand; have less resistance, so easier to pass through tissue but it is slippery and knots may untie * Multifilament: Multiple strands braided/twisted together; holds knots well (better knot security), but have greater capillary action so more susceptible to bacterial colonization (avoid use in infected wounds) and is more tissue reactive |
|  | * Absorbable: Lose most of their breaking strength in 60 days; can be natural like catgut or collagen (absorbed by enzymes) or synthetic like polyglactin 90/Vicryl, PDS (absorbed by hydrolysis) * Location of the suture, suture material, and presence of an infection affects absorption time * Catgut is not good for internal use or skin closure because of its rapid absorption and short duration of tensile strength * Chromic catgut is produced by exposure to basic chromium salts, which increases strength, decreases absorption, reduces tissue reaction * Nonabsorbable: Natural like silk or stainless steel, or synthetic like nylon/polyamide or prolene * Avoid in urinary bladder and urethra because they promote calculi formation * Silk has high tissue reactivity (more likely to cause stitch granulomas); nylon and Prolene have low tissue reactivity * Synthetic suture (Vicryl, PDS, nylon) is more resistant to phagocytic activity; natural suture like catgut is rapidly removed from infected sites where it is exposed to digestive enzymes |
| Cutting needle | * Needle of choice for suturing skin * Penetrates the skin w least amount of trauma |
| Suture sizes | * USP (US Pharmacopeia) sizes sutures based on diameter size in mm from 11-0 to 0 (thinnest) to 7 (thickest)—greater the number of 0s, smaller the diameter * The larger the diameter of the suture, the greater its tensile strength |
| Suture memory | * A suture material’s capacity to return to a previously determined shape after undergoing deformation * Lower or no memory is better because they are easier to handle and knot * Pulling to decrease the curl can decrease memory (make handling easier) |
| Classification of suture patterns | * suture patterns can be classified into three types: appositional, inverting, and tension * Tendons and nerves should be sutured w tension sutures * Viscera should be closed w inverting sutures * Skin should be closed w appositional sutures |
| Inverting vs. everting suture patterns | * Inverted suture patterns turn tissue toward the lumen of a hollow organ, away from the surgeon; wound edges are rolled inward (e.g. purse-string, Lembert) * An everting suture rolls the wound edges outward, away from the surgeon; used to counter the natural tendency of a wound to form a depressed scar (e.g. simple interrupted, interrupted horizontal mattress, simple continuous) * Appositional sutures bring tissues together |
| * Interrupted pattern: * Simple interrupted: Used to close skin, linea alba, muscle layers, SC space, etc. and to secure drains; apposition unless tightened, in which case an inverting pattern occurs and delays healing; common, easy, quick, versatile, but takes time and results w foreign material in wound (suture)      * Interrupted horizontal mattress: Time consuming but ideal in areas of tension (e.g. if skin edges are under extreme tension like in a large skin wound); provides more strength than any other patterns but causes everting pattern if pulled too tight * Vertical mattress (far-far, near-near): Stronger for areas of tension; time consuming, but less risk of everting of wound edges      * Cruciate pattern: Modified horizontal mattress w an X over wound edges | * Continuous patterns: * Simple continuous: Knot at either end of suture line and a continuous suture in between (start w 2 square knots and begun w 4 casts); most common, used in any area where air-tight, fluid-tight apposition is needed      * Ford interlocking (blanket stitch): Very strong, air- and water-tight; more in large animals      * Lembert: Inverting pattern used to close hollow organs (apposes tissue edges but creates an inverting pattern when pulled tight) * Continuous horizontal mattress: Not common |
| When to use which suture | * Tensile strength and tissue needing suturing will determine the suture size * Absorbable suture is common for closure * Subcuticular sutures can be done w continuous or interrupted * Interrupted is preferred for infected wounds since microorganisms aren’t likely to migrate along the patter * Mattress is preferred when there is more distance bw one side of the wound to the other and tension is needed to bring edges together * Surgical glue is preferred for minor cuts and abrasions, and for feline declaws * Staples can help reinforce sutured wound closure to prevent dehiscence |
| Suture layers | * SC suture pattern: Placed in the SC layer by bringing edges of skin into apposition, but doesn’t appropriately close the skin; used to decrease dead space in a wound w skin sutures still needed; mostly continuous, interrupted possible * Subcuticular suture pattern: Placed under the skin; eliminates need for skin sutures bc skin edges are close enough in apposition (e.g. canine castration); mostly continuous, interrupted possible |
| Staples | * External staples: Stainless steel skin staples placed perpendicularly to an incision; takes on a unique shape to inhibit removal w/out a special deice * Internal staples: Stainless steel soft tissue staples; useful in some thoracic surgeries (pulmonary resection, excision of tumors in some locations) and GI surgeries (anastomosis) * More expensive than sutures, but time-saving, provide excellent wound healing, and more resistant to abscess formation; metal clips and staples are inert and made of noncorrosive metal, so infection resistance is similar to minimally reactive suture * Staples often cause scarring * Need special equipment for removal |
| Capillarity | * Ability of suture to allow microbes to wick (be carried) to the interior of the suture strand; neutrophils and macrophages are too large to enter the interstices (i.e. intervening space, especially a very small one) of the fiber, so infections may persist * Can be curtailed if manufacturer coats suture w teflon, wax, paraffin, silicone or calcium stearate to decrease wicking action * Multifilament sutures are treated more often because braided materials (e.g., polyglycolic acid, silk) have degrees of capillarity (monofilament sutures like polypropylene are considered noncapillary) * Capillary suture materials should not be used in contaminated or infected sites |
| Muscle sutures in large animals | * An incision into the abdomen is closed in multiple layers starting w the peritoneum and then closing each muscle layer individually * A heavy absorbable suture material like a size 3 polydioxanone is best |
| Knots    Simple throw Square knot Surgeon’s knot | * One-hand knot tying method is applied where a deep hollow must be reached; uses the square method * Simple throw is the first step * Square method is used at the beginning and end of interrupted and continuous suture patterns; created by making 2 casts (2 simple throws) that are directed in a reverse route and completed by manipulating the tags to exit on the matching side of the loop (most sutures require the square knot have 3 casts) * Knots tied w/out the reversal are granny knots; these have the tags on the opposite sides of the loop (may slip so not used) * Surgeon’s knot begins the same way as the square knot, but the strand is passed thru the loop twice on the first cast; also tied similarly but there is an extra cast; used when tension on tissue presents a problem in using square knot (larger knot means more friction so less likely to open) but has a larger mass and asymmetrical, can’t be tied as tightly so not used unless there is tension * Buried knot for subcuticular or intradermal patterns; suture is passed on the nearby side from close to the surface to deeper into the incision and then crossed to the farthest side and passed from deep in the incision to close to the surface; allows knot to be hidden in tissue (like an upside-down interrupted pattern) |
| Surgical wound healing | * First-intention wound healing occurs w no infection or suppuration, w skin edges held together, and w minimal scar formation * Normal wound healing causes inflammation, which causes minor increases in skin temperature and erythema * Stress on each suture is decreased as number of sutures increase, leading to less risk of dehiscence * Large sutures increase trauma and result in a more foreign material in the patient, but doesn’t affect risk of dehiscence |
| Methods of wound closure | * Primary closure: Wound is closed and sutured immediately; used for clean, new wound w little/no contamination * Delayed primary closure: Wound is closed w/in 1 to 5 days; used for moderately contamination wounds that are free of infection and granulation tissue (wound is left open but protected w dressings during that time) * Secondary closure: Wound is left open 5 to 7 days; healthy edges must be apposed (apposing necrotic edges would lead to dehiscence) * Second-intention healing: Wound is left to heal closed w/out any suturing; contraction and epithelization lead to healing (e.g. holes, shallow injuries) * Third-intention healing: Wound that has formed granulation tissue and undergone secondary closure |
| Steps of wound healing | * Inflammation * Endothelial and fibroblast proliferation * Equilibrium of collagen synthesis |
| Debridement | * Removal of adhered debris and dead tissue from a wound; the exudate is composed of WBCs, dead tissue, and wound fluid * In surgical debridement, dead tissue is removed until fresh bleeding edges are exposed and fresh skin is then sutured * Includes trimming the edges of a jagged tear before suturing * Primary layer of bandaging can also provide debridement * Wet saline dressings are useful to help debride wounds w extensive tissue damage; they absorb and remove inflammatory products from the wound * Antiseptics do not have any wound debridement activity * Dry gauze may stick to a wound, but it does not contribute to debridement |
| Wound dressings | * Semi-occlusive dressing: Allows absorption of excess fluids; includes wet-to-dry bandages, gauze pads, sponges * Occlusive dressing: Impermeable to air; used in later stages; include. natural cellulose, gelatin (don’t adhere to wound) * Wound fluid remains on the wound and keeps it moist, which allows optimal healing—in moist env, debridement is hastened and selective, granulation tissue formation is promoted, and epithelialization is faster * Allowing wound fluid to remain in contact w wound fosters autolytic debridement by endogenous enzymes that break down necrotic tissue |
| Wound dehiscence | * Wound breakdown or separation of layers; can occur due to the tug on the suture (surgical wounds have no strength other than sutures until collagen fibers, fibrins, and granulation tissue are produced in 4-6 days) * Early signs seen within 3 - 4 days after surgery (during the inflammatory phase where wound strength is at its lowest) include serosanguineous discharge (blood and serous fluid), swollen or heated incision * Complete dehiscence of abdominal wounds can result in evisceration (exposure) of abdominal organs, and complete dehiscence of a thoracic wound will result in pneumothorax * May include a serosanguineous discharge from the incision, firm or fluctuant swelling under the suture line, and palpation of a hernial ring or loop of bowel beneath the skin * Obesity increases risk of infection and dehiscence due to decreased vascularization of fatty tissue leading to decreased capacity to heal * Interrupted sutures have lowest risk of dehiscence because suture tension is more controlled and failure of one knot doesn’t mean failure of the whole suture |
| Wound contamination (clean to dirty) | * Clean: Wound created under sterile conditions (e.g. surgical wound like ovariohysterectomy) * Clean-contaminated: Minimal contamination (e.g. surgical incision into the GI tract w/out spilling contents, traumatic wound after flushing and debridement) * Contaminated: Heavy contamination (e.g. leakage of intestinal contents or fresh traumatic wounds like road rash after hit-by-car) * Dirty: Old traumatic wounds, active infection w purulent exudate (e.g. unattended, infected laceration) |
| Abscess | * A "walled-off" or circumscribed accumulation of pus |
| Pneumothorax | * Air within the chest causing lung collapse |
| Fenestration | * Window (e.g. fenestrated drape is a drape w a window opening in the middle where surgery is performed) |
| - ectomy  -otomy  -ostomy  -rrhapy  -pexy | * -ectomy: Removal * -otomy: Incision * -ostomy: Surgical creation of an artificial opening * -rrhapy: Surgical repair by suturing * -pexy: Surgical fixation |
| Drains | * Drains provide an escape path for unwanted air and/or wound fluids, which prevents/reduces seroma or hematoma formation in tissue pockets or dead space * Accumulation of exudate in a wound favors infection; excessive fluid prevents phagocytic cells from reaching bacteria w/in a wound * Drains are needed when wounds produce fluids and exudates for several days after initial treatment * Passive drains (Penrose) allow fluid to flow along the drain surface as a result of capillary action; these must exit in a dependent location so fluids can gravitate toward the exit * Active (closed suture) drains create a vacuum w/in the wound and allow the fluid to be removed via a rigid fenestrated drain into an external container; used for more extensive wounds or wound w a lot of drainage, but must be removed un 3-5 days since it causes extra drainage |
| Stay sutures | * Sutures that are placed into the lumen of a hallow organ to allow that organ to be manually manipulated * Surgical assistant clamps the free ends of the star sutures together w a hemostat and cutting the suture ends for removal * During a cystotomy, stay sutures would be placed to hold the bladder up and open while removing bladder stones * For intestinal surgeries, stay sutures would be placed in the GI tract for manipulation of intestines |
| Granulation tissue | * Formed after dead and damaged tissue is removed from a wound by inflammation; must form on the floor of the wound before wound contraction can begin, creates a surface for reepithelialization * Consists of collagen fibers and capillaries; is a source of fibroblast, myofibroblasts, endothelial cells, inflammatory cells, and new blood vessels, all connected by extracellular matrix * Fibroblasts deposit collagen into the wound, which strengthens it * Once granulation tissue covers the whole wound bed, fibroblasts decrease in number and are replaced by collagen-rich tissue and epithelial cells start migration, beginning epithelialization starting w wound margins * Will be pink if blood supply is appropriate, pale otherwise |
| Exuberant granulation tissue | * When granulation tissue grows above skin level; aka proud flesh * Depth of the wound is not a factor in the formation of proud flesh, but infection, missing tissue, and location of the wound may increase its likelihood * Common in open wounds on the distal aspect of the limb of a horse * Limb immobilization (e.g. cast), bandaging, application of caustic agents, cryotherapy, electrocautery, and topical corticosteroids can prevent it * Surgical excision is the best method to remove and control it |
| Sterilization  Disinfection | * Sterilization: Elimination of all living organisms and viruses * Disinfection: Destruction of vegetative forms of bacteria but not spores; chemical or mechanical destruction of pathogens * Cleaning and disinfecting or sterilization process is known as decontamination * Both are used to prep surgical materials, which one is chosen depends on the material and intended use |
| Levels of disinfection | * Low-level dis |
| Sterilization methods | * Physical methods: * Filtration: Use of a filter to separate particulate material from liquids and gases; used on pharmaceuticals * Radiation: Used in manufacturing of gloves and some sutures (gamma or UV) * Heat: Causes protein denaturation; dry heat causes protein oxidation, and is used for materials that can’t tolerate moisture but can withstand high temperatures for longer times, like powders or oil (not used in vet med); moist heat kills by coagulation of proteins, and includes boiling water (not hot enough, can only disinfect) or pressurized steam— quickest and most reliable form of sterilization * Chemical methods: Liquid sterilization w glutaraldehyde (e.g. endoscopic instruments), gas sterilization w ethylene oxide (electrical drill; flammable and carcinogenic), and hydrogen peroxide gas plasma (plasma sterilization is a low-temperature sterilization technique to sterilize heat-sensitive items) |
| Altering disinfection time w liquid chemicals | * Warming the solution speeds up the chemical reactions necessary to kill microorganisms * Cooling the solution can prolong the time needed to achieve the disinfectant state * Diluting the solution will reduce efficacy, but increasing the strength of the solution will not increase the speed of kill |
| Disinfectants | * Chemical agents applied to inanimate objects to destroy bacteria; only chemical “sterilizers” can destroy spores, tubercle bacilli, and viruses as well as bacteria * Alcohol: Bacterial, but ineffective against spores, fungi; no residual effect; ethyl and isopropyl alcohol more effective than methyl; would need to be applied multiple times if disinfecting a cage w possible contaminants * Phenols * Quaternary ammonium: Synthetic cationic detergents effective against gram-positive and -negative bacteria but not spores/viruses; low toxicity; don’t require long contact time (best for e.g. cleaning after contaminated wound) * Chloride: Broad bactericidal and viricidal activity but cytotoxic on living tissue; bleach (sodium hypochlorite) * Aldehyde: Formaldehyde (for specimen preservation) and glutaraldehyde (for chemical sterilization in cold trays and for endoscopic equipment); toxic and irritating to living tissue * Chlorhexidine: Contact time of at least 5 minutes * Cold sterilization: Soaking instruments in chlorhex or glutaraldehyde |
| Antiseptics | * Antisepsis is prevention of infection by inhibiting growth of infectious agents in living tissue * Chlorhexidine: Antimicrobial agent against bacteria, molds, yeasts, viruses; rapid onset and longest residual activity that isn’t affected by alcohol; not a skin irritant so used for surgical prep, lavage solution (diluted) * Iodine: Antimicrobial agent against bacterial spores; used for prep (povidone-iodine), topical wound therapy, joint/body cavity lavage including conjunctiva (diluted) * Alcohol: Never for open wounds * Phenols: Replaced by povidone-iodine and chlorhexidine |
| Cleaning instruments | * Presoaking: Placing instruments in distilled water mixed w detergents like Haemo-Sol to soften dried blood and debris * Precleaning: Rinsing instruments in distilled water * Decontamination: Manual cleaning of instruments in a commercial instrument detergent solution (diluted w cold distilled water) w a brush to break down biological debris * Ultrasonic cleaning: Uses a solution of distilled water and enzymes (solutions w surfactants that reduce surface tension are preferred) and sound waves to form bubbles that produce a scrubbing effect (aka cavitation) to remove very small particles of blood and tissue (esp. good for grooves, lock box, etc.) * Rinsing: Distilled water is used to remove any mineral deposits left from ultrasonic cleaning * Lubrication |
| Types of autoclaves | * Gravity displacement autoclaves (N) gradually replace the air inside using gravity (air is heavier than water vapor, leading to its displacement thru a port in the bottom as steam enters) * Positive pressure autoclaves vent steam into the sterilization chamber after it’s pressurized in another one to blow all air out * Negative pressure autoclaves (S) use a vacuum pump to remove air and achieve highest sterility assurance levels * Aka pre-vacuum autoclave * Larger, can hold more items, and more effective |
| Autoclave sterilization indicators | * Three basic criteria for autoclave sterilization: (1) presence of steam at the proper combination, (2) exposure time, and (3) temperature—121°C (250 °F) for a minimum of 13 minutes at 15 psi pressure (chamber is sealed before setting the timer so that process isn’t included in the timing) * Autoclave tape, fusible melting pellet glass, culture tests, and chemical sterilization indicators; best to use all four in combination * Tape only confirms its own exposure to steam, not indicate whether proper requirements are met; pellets indicate steam reached 118 C; culture tests confirm microorganisms were killed but it takes 1-7 days * Chemical autoclave indicators are the only type that can provide immediate information all requirements (their color changes when subjected to saturated steam for adequate time periods); most clinics use tape outside and chemical indicators in the center |
| Bowie Dick test | * A daily diagnostic test for pre-vacuum steam sterilizers that verifies the sterilizer can effectively remove air and properly penetrate steam through porous loads * Doesn’t prove complete sterilization because doesn’t say anything about time |
| Packing the autoclave | * Packs are placed vertically to receive best circulation * Heavy packs should be placed at the periphery, where steam enters the chamber * Small amount of air space must be allowed bw packs to facilitate flow of steam (1 to 2 inches in bw and away from the walls) * Linen packs must be placed vertically and not be stacked * Packs shouldn’t be larger than 30x30x50 and 5.5 kg, and should be placed 1-3 inches apart |
| Safe storage times for sterile packs | * Single-wrapped linen: 2-3 days * Double-wrapped linen: 4 weeks * Single-wrapped muslin: 1 week in closed cabinet, 2 days in the open * Double-wrapped muslin: 7 weeks in closed cabinet, 3 weeks in the open * Single-wrapped crepe paper: 8 weeks in closed cabinet, 3 weeks in the open * Single-wrapped muslin sealed in 3 mL polyethylene: N/A in closed cabinet, 9 months in the open * Heat-sealed paper and transparent plastic pouches: N/A in closed cabinet, a year in the open * Items sterilized w gamma radiation remain sterilized until opened |
| OR attire | * All nonsterile personnel entering the operating room must wear a cap, mask, booties, and clean scrubs * Surgeon and the assistant wear sterile gowns as well * Back of the gown or the body is not considered sterile * Clean, freshly laundered scrub suits should be donned just before entry into the surgery room * Scrubs must be dedicated to surgery use only to avoid contamination; should not be worn while treating other patients * Nonscrubbed personnel should always face the surgical field to look out for contamination; should never walk between two sterile fields |
| Surgical hand scrub | * Mechanical removal of dirt, oil, and bacteria and inactivation of any remaining bacteria by coming into contact w the antimicrobial solution—sterilization of hands is not possible * Counted brush strokes: Counts the number of brush strokes on each skin surface—10 to 25 on each surface of fingers, hands, and arms before rinsing, done four times * Another source says 12 strokes for each finger, from pinky to thumb * Timed: Repeatedly scrubbing and rinsing for at least 5 minutes of skin-to-soap time; more common |
| Masks | * Molded masks permit air to escape from beneath, so only worn if there is no facial hair to cover * Flat-style masks have pressed folds with a metal nose band that can be used to customize the fit |
| Gloving | * Closed gloving provides the least chance of glove contamination since fingers never extend past the sterile sleeve cuff * In open gloving, only the skin surface of the glove is touched, gloved hand picks up the second glove under the folded cuff, and the cuff of the first glove is not pulled up until the second glove is fully on * Accidental contamination is possible in open gloving and assisted gloving |
| Gowns | * Folded so that the inside of the gown faces outward since they should be grasped from the inside portion of the gown to maintain asepsis * Commonly made of cloth or paper * Sterilized using a steam autoclave |
| Scrubbing the patient | * Either chlorhexidine or povidone-iodophor * Antiseptic microbicide Betadine is sprayed after scrub |
| Sterile field | * Front of the surgical gown, from waist to the shoulder and down the arms * Hands kept above elbows and table, and scrubbed in staff pass each other back to back (never turning their backs on the patient) to maintain sterility |
| Passing instruments | * Instruments should be passed w the first ratchet closed, ring handles facing the floor, and the tips facing the ceiling, concave side up |
| Fracture healing | * Requires apposition (realignment) of the bones, reduction (correction) of the facture, and fixation (stabilization) * Reduction of a fracture (or fracture apposition reduction) is bringing the opposing ends of the fracture back into alignment; placing pins through the marrow cavity will help stabilize the fracture after it has been reduced, aiding in healing the injury * External coaptation is the application of an external appliance, such as a splint or cast, to reduce further disruption to fractures and to enhance pain management * A bandage can also be used after surgery to provide additional postoperative support |
| Fracture bandages | * Robert Jones bandages: Used for any long bone fractures (only one that cannot be used as external coaptation when surgery isn’t an option) * Modified Robert Jones: Used for carpal, metacarpal, tarsal, metatarsal, and phalangeal fractures; metal or plastic splint is used * Ehmer sling: Used for hip luxation (dislocation of femur from the hip socket: * Spica split: Used for humeral or femoral fractures * Velpeau sling: Used for scapular fractures |
| Surgical repair of fractures:  Internal fixation | * Rigid fixation placed on or in the bone surface or medullary cavity * Usually involves bone plates, screws, interlocking nails, intermedullary pins, Kirschner wires, and cerclage wire * IM pins are driven into the medullary cavity using a Jacob’s chuck (one long metal prong inside the bone); they can be used alone or stacked, where multiple IM pins are driven into the medullary canal * IM pinning is least expensive, but not as stable * Wires can circle around the bone or drilled into it and then circle around |
| Surgical repair of fractures:  External fixation | * Applied through the exterior of the limb (skin and muscle); uses threaded cross-pins that are drilled into the bone and then attached to bars w clamps, nuts and bolts, or aluminum rings to make an external tension device that proves rigid stability until fracture is healed * Adjusted weekly/biweekly; removed once fracture has closed * Good for long bone fractures or temporary joint immobilization; not used for pelvis * Has poor drainage if infected (osteomyelitis) * Include SK fixation, Kirschner-Ehmer fixation, ring or circular fixation * Cast and splints are also used for external fixation |
| Anesthetic depth | * Reflexes are indicative of anesthetic depth * Vital signs are used primarily to determine patient safety; only loosely correlated w depth of anesthesia |
| Ligation | * Can be used to occlude blood vessels and prevent bleeding * Vessels can be ligated via pressure, suture material, or cauterization * Transfixation ligatures secure vessels or pedicles by passing a suture through the tissue, tying it on one side, passing the needle back under the tissue, and tying it again on the other side; more advantageous/secure than circumferential ligation because suture penetrates vessel and ligature is held in place at a given tissue level |
| Popliteal | * Back of the knee (e.g. popliteal lymph node) |
| Strike-through contamination | * Occurs when liquids soak through a drape from a sterile area to a nonsterile area and vice versa * Prevent drapes and surgical gowns from becoming wet during surgery * Plastic prevents bacteria from penetrating the surgical drape when the top surface of the drape becomes wet because it is not subject to capillary action |
| Incisions | * A ventral midline incision is made along the linea alba, extending from the xiphoid process to the umbilicus; used when exploring the upper abdomen * A flank incision is made in the lower quad of the abdomen; used in cryptorchid procedures, on a standing animal undergoing c-section. * A paracostal incision is made in the upper quad of the abdomen; used to expose the kidneys and adrenal glands (smaller) * A paramedian incision refers to off the midline |
| Chemical cauterization | * Used especially when toenails have been clipped too short * Not used in surgery because it is traumatic to adjacent tissues (slough of surrounding tissue may occur) |
| Cranial cruciate ligament (CCL) rupture | * Same as anterior cruciate ligament (ACL) in humans; both cranial and caudal CL are major stabilizing structures in the knee, originating on either side of the femoral condyle then coursing across the intercondylar fossa and attaching on opposite sides of the tibia; protect against hyperextension of stifle joint and limit internal rotation of tibia * CCL ruptures cause tibia to slide forward and femur to fall back, creating a shear force called “cranial tibial thrust” * CCL rupture is the most common cause of hind limb lameness in dogs—can be traumatic (acute) or degenerative (chronic); meniscus, the fibrocartilaginous structure bw femur and tibia that cushions and centers the joint is also commonly damaged in dogs w ruptured CCL * Surgery necessary in case of complete or partial rupture |
| Diagnosing CCL injury | * Diagnosed w palpation, tibial compression test, and cranial drawer test * Palpation reveals muscle atrophy, pain, joint effusion, asymmetry * Flexion and extension of stifle joint may result in an audible click due to displacement of meniscus * Exam of joint reveals a positive cranial drawer sign (cranial displacement of tibia) and increased internal rotation of tibia |
| CCL repair | * Intracapsular techniques involve replacement or reconstruction of CCL using biologic tissues and synthetic suture material from the lateral side * Extracapsular techniques (tightrope and fascial imbrication) involve placement of sutures outside the stifle joint on the lateral side; sutures can be monofilament, nylon, nylon fishing line; faster and easier * Tibial plateau-leveling osteotomy: Both of the above work by recreating the passive constraints of the stifle joint, but TPLO alters the active constraints—by changing the angle of the tibia, it alters joint mechanics and creates a new plateau that eliminates cranial tibial thrust; a bone plate is inserted through a medial incision |
| Laminectomy | * Surgical excision of the dorsal arch of a vertebra * Performed to relieve the symptoms caused by ruptured intervertebral disks |
| Resection and anastomosis | * Surgical removal of a segment of intestine and reattachment of the healthy ends * Done when a part of the bowel cannot be saved, e.g. in case of a foreign body |
| Laparotomy  Celiotomy | * Laparotomy: Flank incision into the abdomen * Celiotomy: Surgical incision into the abdomen * Can be used interchangeably |
| Rumenotomy | * Indicated in cases of gorging on feed, ingesting foreign object, etc. leading to rumen stasis (bloat) requiring manual evacuation of rumen contents * Performed via a left-flank abdominal incision (left paralumbar fossa) in a standing cow due to position of rumen against left body wall * Local anesthetic (lidocaine) given using an inverted L block * Rumen content needs to be replaced after surgery by performing transfaunation; healthy content can be removed from another cow by using stomach tube and dose syringe |
| Peritonitis | * Inflammation of the peritoneum (i.e. lining of the abdominal cavity) * A foreign body’s perforation of the stomach can lead to peritonitis |
| Ablation | * Removal, especially by cutting * Surgical procedure in which the cartilaginous external ear canal is removed and closed is ear canal ablation * Total ear canal ablation involves removal of the whole ear canal and the pinna followed by a bulla osteotomy |
| Onychectomy | * Declawing; an orthopedic procedure where the claw and associated third phalanx are removed (distal phalanx and nail are surgically amputated) * Performed 3 to 12 months of age and on the front paws only, if elective * Can be done using the Resco nail trimmer technique, a size 12 scalpel blade, or CO2 laser; all will require a tourniquet distal to the elbow to control hemorrhage |
| Tendonectomy | * Claws aren’t removed, but the tendons under the paw are so that they remain retracted into the paw |
| Compartment syndrome | * Condition that results from increased pressure within a closed fascial or osseofascial space, which reduces capillary blood flow to the tissues leading to ischemic necrosis if left untreated * Although any soft tissue can be affected, muscles are most common * Can arise as the result of local trauma, bandaging, or positioning during anesthesia (may occur in the "up" side if the limbs are not positioned properly or if prolonged hypotension is allowed to occur) |
| Gastric dilation and volvulus (GDV) | * Swelling and rotation of the stomach on its mesenteric axis * Dilation is stretching beyond normal, volvulus is rotation; simple gastric dilation (w/out volvulus) is possible in small animals * Signs include severe distension of stomach (beyond rib cage), hypersalivation, abdominal pain, nonproductive attempts to vomit, signs of shock * True emergency; treatment consists of (1) reversing shock, (2) decompressing stomach (remove air, then lavage), (3) correcting fluid/electrolyte imbalances, arrythmias, (4) correcting position of stomach along w partial gastrectomy to remove dead tissue if needed, (5) gastropexy to attach stomach to the body wall to prevent future GDV (doesn’t prevent future bloat) * Oral meds can’t be administered due to twisting of stomach * Rarely seen in cats, mostly in middle-aged to older large dogs |
| Gastropexy | * Surgery that attaches the stomach to the abdominal wall to prevent GDV * The pyloric antrum is attached to the right side of the abdominal wall * Pylorus is the part of the stomach that connects to the small intestine and is surrounded by a sphincter muscle * Can be belt-looped, circumcostal, incorporating, laparoscopic, or incisional |
| Pyometra | * Accumulation of purulent discharge in the uterus; closed or open cervix (discharge drains through open cervix) * Can rupture and release purulent material into the abdominal cavity, leading to septicemia or endotoxemia * Stump pyometra is possible in spayed females if ovarian tissue was left behind * Signs include decrease appetite, lethargy, increased thirst and urination, possibly discharge; usually high WBC count * Medical treatment instead of OHE is not advised * More common in dogs, but possible in cats too |
| C-section (hysterotomy) | * Primary indication is dystocia * In cattle, c-sections are commonly performed thru the left paralumbar fossa (left-flank incision) |
| Resuscitating puppies after c-section | * Hypothermia, hypotension, and hypoxia need to be prevented * Clearing nasal passages and mouth from secretions w a bulb syringe helps prevent hypoxia * Rubbing the thorax will help expel fluid from the lungs and help the puppies breathe, also resulting in less heat loss * Administering IV fluids to mother will help maintain BP for both mom and puppies * Resuscitation efforts should continue until puppies have 10 breaths per minute * Swinging is no longer recommended |
| Enucleation | * Complete removal of the eyeball * Transconjunctival approach can be done if there is no intraocular infection—an incision around the conjunctiva; less bleeding, faster * Transpalpebral approach is done w an elliptical incision around the eyelids and the globe; conjunctiva, eyelids, and nictitating membrane are removed |
| Perineal urethrostomy | * Performed on male cats w recurrent urethral obstruction * A new, permanent opening is created in the urethra on the perineum (area between the scrotum and the anus) |
| Caslick | * Common in mares w poor perineal confirmation w a sunken anus and slopping forward vulva, which leads to frequent infections * Performed when greater than 4 cm of the vulva lies dorsal to the pelvis * Sutures will need to be removed if the mare is to give birthf |
| Common procedures for piglets | * Tendency to cannibalize, so milk/needle teeth are cut back * Tail is docked * Inguinal hernias are common, so checked during castration * Iron dextran is given prior to castration to keep piglet from becoming anemic |
| Surgery scheduling | * Difficulty, length, contamination, patient status, equipment needs and turnover should be taking into consideration * Schedule from cleanest to dirtiest—start w whichever surgery requires the cleanest environment (e.g. orthopedic) * More difficult cases should be scheduled earlier in the day * Orthopedic surgery order: Joint replacement, metatarsal fracture, cranial cruciate ligament repair, compound radial fracture * Soft tissue order: Noninfective thoracic procedures, lean abdominal, contaminated, and dirty procedures |
| Perioperative | * Time immediately before and after a procedure * Includes three main stages: preoperative (before), intraoperative (during), and postoperative (after). |
| Nervous tissue damage | * Basic functional unit of the nervous system, neuron, is incapable of reproduction, so damage to the nervous system is often repaired by scar tissue—nervous tissue has the poorest potential for healing and return to normal function after damage and effective surgical repair |
| Pleural effusion | * Pleura is the two-layered membrane covering the lungs * Pleural effusion is the accumulation of fluid in the thoracic cavity * Treatment includes oxygen supplementation and thoracocentesis * vs. ascites (fluid in the abdominal cavity) |
| Hypocarbia | * Decreased carbon dioxide levels in the blood * Can be attributed to increased RR, light plane of anesthesia, pain, or overzealous artificial ventilation |
| Postoperative care | * Unless very large or ruptured, postoperative seromas are not important * Horses must be exercised after 24 hours following castration to promote drainage from the surgical site and prevent excessive swelling |
| Emergence delirium | * Signs of excitement, possibly w exaggerated and uncontrolled movements including thrash around, crying out, paddling * Happens as animal travels back through stages of anesthesia and gets to stage II (excitement); ketamine and similar dissociatives may cause hallucinations like they do in humans, and opioids may cause overstimulation from sound and light |
| Infection | * Four main factors determine whether infection occurs: * Number of microorganisms—there must be sufficient microorganisms to overcome the defenses * Virulence of microorganisms—their ability to cause disease * Susceptibility of the animal—some individuals have a greater natural resistance to infection * Route of exposure—some routes are more likely to result in infection * Length of exposure time doesn’t determine whether the infection occurs |
| Hemorrhage | * Signs include pale MM, slowed CRT, rapid RR, abdominal bloating, swelling around surgical site, hypotension, leading to hypovolemic shock * Abdominocentesis, thoracocentesis, etc. can be performed to confirm internal bleeding (frank blood means hemorrhage) * Finding clots in the drawn blood indicate fresh bleeding—otherwise blood collected won’t clot because it lacks fibrins since they were used when clotting took place * RR increases w internal bleeding |
| Hemostatis and hemostatic agents | * Cautery: Used to stop bleeding in vessels or soft tissues * Monopolar cautery uses a single active electrode at the surgical site and a return pad on the patient, allowing current to flow through the body for cutting and coagulation over larger areas * Bipolar cautery uses two electrodes on an instrument like forceps, confining the current to the tissue and providing precision * Bone wax: Used on a cut bone surface to assist w hemorrhage control; made of bees wax and a softening agent; poorly absorbed so used sparingly * Gelfoam: Used to stop bleeding in a tissue defect such as punch biopsy site on the liver; swells up to fill the defect; made of absorbable gelatin sponges * Surgicel: Used to stop bleeding in tissues; enhances clot formation when laid on a tissue; a absorbable cellulose product, but some recommend its removal after hemostasis because it might inhibit callous formation and lead to infection |
| Blood loss estimations | * A 3x3 sponge holds 6 mL of blood * A 4x4 sponge holds 10 mL of blood |
| Capillary action | * Movement of a liquid through a narrow space against gravity * Caused by the combined forces of cohesion (liquid molecules sticking to each other), adhesion (liquid molecules sticking to a solid surface), and surface tension |
| The OR | * Daily cleaning should be done at the end of the day because cleaning creates airborne dust that takes several hours to settle * Surgical floors must be cleaned daily, whether used or not * Ventilation system should provide 15–20 air exchanges per hour |
| Curettage | * A medical procedure that involves scraping or scooping out tissue from a body cavity, surface, or lesion using a spoon-shaped instrument (curette) |
| Epidural anesthesia | * Caudal epidural anesthesia is routinely used for analgesia of the tail, perineum, anus/rectum, vulva, and vagina * Easily performed on large animals * Site of injection is bw the first and second coccygeal vertebrae on the dorsal midline |
| Eviscerate | * Protrusion of abdominal organs through the suture line * Happens if both the muscle layer and the skin sutures of an abdominal incision break down |
| Pericardiocentesis | * Used to treat pericardial effusion * Performed on the right side of the chest to avoid damage to lungs and coronary arteries * Chest is shaved and surgically prepped from the 3rd to the 7th ribs |