

Arthroscopy Mini Series

Session 1: Arthroscopic equipment and its use

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Arthroscopy Miniseries

Session 1

Arthroscopic equipment and its use

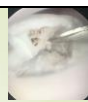
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Miniseries Session 1 Course Outline

- Equipment for arthroscopy
- Using arthroscopic equipment
- Preparation for arthroscopy
- Indications for arthroscopy
- Positioning for arthroscopy




What is arthroscopy?



- Important diagnostic tool
- Allows visualisation of hard to reach areas of the musculoskeletal system
 - Magnification improves accuracy of diagnosis
- Important prognostic tool
- Assessment of the health or disease of joints allows us to make decisions in case management
- 'Key hole' surgery – the original minimally invasive surgery
 - Minimal disruption to soft tissue means less discomfort
 - Lower morbidity
- But...

...the arthroscope is not a magic wand!



Use it wisely

Equipment for arthroscopy

Arthroscope

- Fibreoptic telescope that transmits light into the joint
- Inner lenses transmit that light to a camera
- Described by
 - Diameter
 - Working length
 - Distal lens angle (viewing angle)



Diameter

- Common sizes are 2.7, 2.4 and 1.9
- Larger diameter
 - Larger field of view
 - Greater resistance to bending
 - Last longer
- Smaller diameter
 - Minimise joint trauma
 - Greater manoeuvrability in smaller joints
 - Less durable

Diameter

- 2.7mm
 - Shoulder and stifle in most dogs
 - Elbow in larger dogs (Labrador and upwards)
- 2.4mm
 - All joints in medium and large dogs
- 1.9mm
 - Elbow in smaller dogs >10kg
 - Corpus and tarsus in larger dogs

Lens angle

- Typically 30 degrees
- Allows larger field of view and improved visualisation



Camera

- Converts light from arthroscope to monitor image
- Clip on camera is most common
 - Less expensive
 - More susceptible to fogging
 - Most commonly used camera
- Direct coupling "glass to glass"
 - More expensive and less susceptible to fogging
 - Possibly better image quality
 - Slower to change arthroscopes

Camera specifications

- Single chip or three chip
 - Better image quality with three chip cameras but more expensive
 - Single chip adequate for most applications
- Most cameras will fit most arthroscopes
- All cameras can adjust image magnification and focus
 - Some have pause and record buttons
 - Check compatibility with control box
- Control box is camera-specific and allows colour and white balance
- Monitor should be at least 40cm diameter

Camera bags

- Allow transfer of unsterile camera to sterile field
- Camera dropped into sterile bag
- Surgeon holds the camera inside the bag
- Assistant (unsterile) extends sheath of camera bag along cable
- Arthroscope connected to camera through window in bag
- Adhesive strips secure bag to arthroscope ensuring sterility maintained
- Allows rapid turn around of equipment or rescue if break in aseptic technique



Paralle Hospital Supply Co

Light cable

- Fiberoptic cable that provides light to the joint
- Attaches to light post on arthroscope
- Attachment to light post is typically screw on
- Can be variation in screw diameter between arthroscopes
 - Adaptors often needed
 - Can be awkward to use and problematic if dropped
 - Variation between manufacturers
- Attachment to light generator is different to arthroscope attachment
 - Make sure you hand the correct end to the assistant!

LIGHT CABLE



Cannula

- Steel tube used to pass arthroscope into the joint
- Allows fluid to run between the arthroscope and cannula into the joint
- Maintains arthroscope port
- Protects arthroscope
- End is bevelled to match angle of arthroscope
- Width and length-specific to arthroscope
- Inserted with sharp or blunt trochias
- Arthroscope locks into cannula
- Fluid line attaches to cannula
 - Fluid flow can be controlled from cannula

Cannula



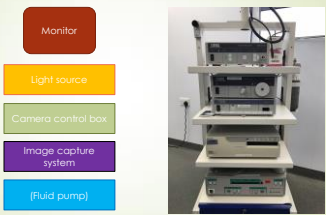
Cannula guides



Care of equipment

- Bending, scratching and dropping can destroy the arthroscope
- Always cover lenses when not in use
 - Preferable to keep in housing
- Clean lenses carefully
 - Sterile cotton buds or lens tissues
- Enzymatic cleaning of camera and arthroscope preferred
 - Recommended to have one person trained in this and ensure only they clean
- Do not force arthroscope when in joint
 - Breaks optical fibres
 - Look for warning signs of bending

Arthroscopy tower



- Monitor
- Light source
- Camera control box
- Image capture system
- Fluid pump

Light source

- Joint illumination
- Typically xenon or tungsten-halogen (older)
 - Xenon has better colour definition but more expensive
- Light units will automatically adjust light intensity
- White balance is adjusted prior to entering joint
- 200-300W bulbs
 - Last around a year in regular usage
 - Need to keep a spare on the shelf
 - Eye-wateringly expensive!
- LED light sources now available
 - Long life expectancy

Image capture

- Digital
 - Strongly recommended
 - Allows moving and still image capture
 - Important for patient record
 - Useful to directly integrate to client record
- Image printer
 - Probably not much cheaper in the long run
 - Time consuming to file (and recover) images
 - Quality inferior
- Not essential

Image capture



Courtesy K Storz

- Combination units
 - LED light source
 - Monitor
 - Digital image capture

Irrigation


- Constant, pressurised flow of fluid essential
 - Distention of joint
 - Lavage of haemorrhage and debris
 - Improved visualisation
 - Pressure control of haemorrhage
- Typical pressure of 40-100 mmHg
- Luer-Lok connector to cannula
- Lactated Ringers (Hartmann's) preferred as saline is acidic
- Fluid passes between arthroscope and cannula into joint
- Gravity, pressure bag and fluid pump

Gravity and pressure bag

- Gravity
 - Direct administration from fluid bag to cannula via drip line
 - Inadequate pressure
- Pressure bag
 - Direct administration from fluid bag to cannula via drip line
 - Fluid bag compressed to increase pressure
 - Inexpensive, reliable system that is easy to use
 - No concerns regarding overpressurisation
 - Poor pressure control and low maximum pressure
 - Needs to be constantly repressurised
 - Y connectors can be used to allow multiple bags to be connected saving frequent changes



Fluid pumps




- Precise control of pressure and flow rate
 - Only pressure is important for us
- Very expensive
 - Both unit and consumables are expensive
 - Some companies will provide the unit on the basis you purchase consumables
- Supply lines are unit specific
 - Can't use normal drip lines
 - Supply lines are disposable (not reusable)
- Pressure provided by peristaltic roller
 - Centrifugal impeller also available

Egress cannula

- Fluid outflow essential to lavage joint
 - Too small and lavage reduced
 - Too large and pressure lost
- Many commercially available cannulas
 - Elbow
 - 1.5" green (21G) needle
 - Instrument portal increases flow
 - Shoulder
 - 1.5" green (21G) needle
 - May consider a wider needle if higher flow rates needed to clear debris

Fluid management

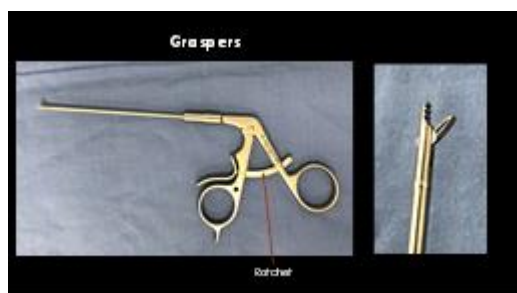
- A long, multi-joint surgery may use >10l fluid
- Fluid on the floor is a safety hazard and time consuming to clean
- Surgical drapes have to be waterproof
- Plastic covering drapes can be used
 - Often have pockets to catch fluid
- Incapads can be used on the floor
- Active floor suction can be used
 - Noisy and variably effective



Hand instruments

- Probe
 - Tactile assessment of tissue and tissue manipulation
- Hand burr
 - Abrasion surgery procedures
- Instrument port
 - Facilitates easy changing of instruments
- Switching stick
 - Used to place instrument port
- Grasper
 - Fragment and cartilage retrieval
- Cutting hook
 - Sectioning tendons and cartilage



Sterilisation of equipment

- Manufacturer-specific
 - Autoclave
 - Arthroscopes can usually be autoclaved
 - Surgical tools
- Ethylene oxide or chemical
 - Camera and light cable
 - ETO readily available as Anprlene
 - Chemical sterilisation adequate although care required

Using arthroscopic equipment

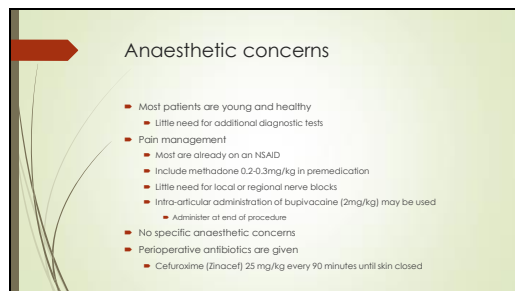
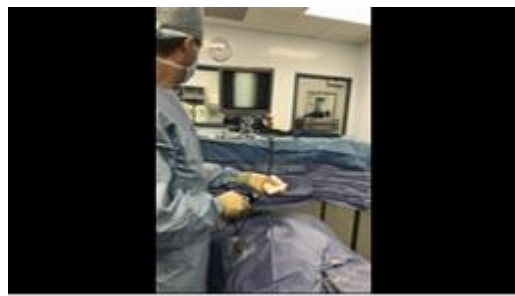
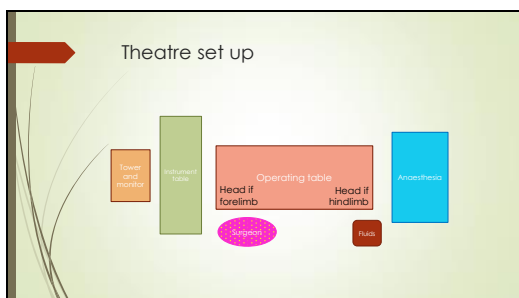
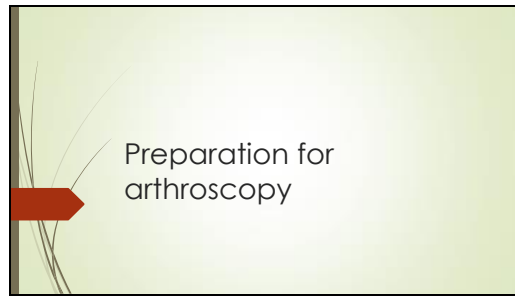
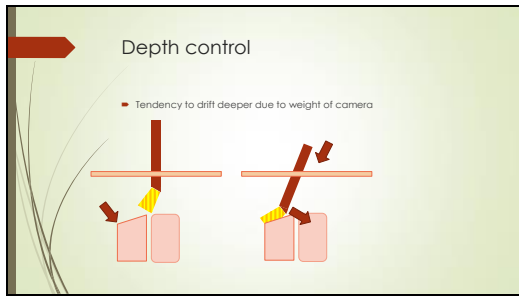
Opposite hand movement

Rotation to improve visualisation

- Light beam angle is opposite light post
- Rotate light post instead of moving arthroscope

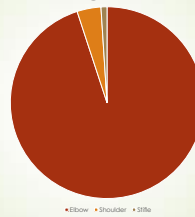
Orientation in space

Triangulation



Indications for arthroscopy

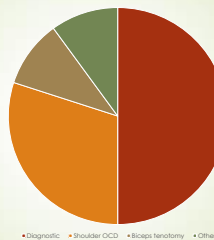
Cases having arthroscopy %



Indications for shoulder arthroscopy

- Common
 - Humeral head osteochondrosis
 - Biceps tendon of origin tendinitis
- Less common
 - Shoulder instability
 - Diagnostic
 - Glenoid osteochondrosis
 - Glenoid osteophytosis
- Contraindicated
 - Osteoarthritis

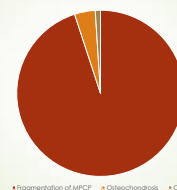
Indications for shoulder arthroscopy



Common indications in the elbow

- Elbow dysplasia
- Osteochondrosis
- Humeral condylar fissures
- Diagnostic biopsy
- Osteoarthritis
- Less common
 - Ununited anconeal process
 - Humeral condylar fractures
 - Flexor enthesiopathy

Indications for elbow arthroscopy %



Arthroscopy of the carpus

- Assessment of radiocarpal joint and associated structures
- Indications
 - Evaluation of intra-articular fractures
 - Assessment of ligament damage
 - Removal of foreign materials
 - Removal of bone chips
 - Biopsy
- In reality rarely used
 - Improved diagnostic imaging (CT)
 - Fluoroscopy can be used intraoperatively

Arthroscopy of the hip

- A very rare indication
- Challenging in osteoarthritis hips
- Most common application has been assessment of joints prior to performing double or triple pelvic osteotomy
 - DPO/TPO avoided if significant osteoarthritis
- Other indications include biopsy, foreign body and assessment of intra-articular structures

Arthroscopy of the stifle

- Common indications
 - Assessment of intra-articular structures
 - Cruciate ligaments, menisci, cartilage
 - Cranial cruciate ligament disease
 - Debridement of ligament and treatment of meniscal injury
 - Osteoarthritis
 - Use in human knee osteoarthritis has no evidence of benefit
 - Rarely used in canine osteoarthritis
 - Osteochondritis
 - Assessment and debridement
 - Trauma

Arthroscopy of the stifle

- Technically difficult
- Usually requires a motorised shaver
 - Expensive to buy and maintain
- Time consuming
- Requires creation of medial and lateral ports
 - Overall joint incision may be larger than a mini arthrotomy
- Stifle distraction required
 - Internal can be done with standard stifle distractor through port
 - External devices drill pins into femur and tibia then distract these
- Accuracy of detection of joint disease may be superior



Arthroscopy of the tarsus

- Very few indications
- Very difficult to perform especially if osteoarthritis is established
- Examination of the talocrural joint is possible
- Most commonly used for removal of osteochondral flaps
 - Questionable clinical benefit
- May be useful to assist in assessment of fracture reduction
 - Fluoroscopy preferred

Positioning for arthroscopy

The importance of consistency

- Establishing camera and instrument ports is the most critical stage of arthroscopy
- Correct port placement ensures best possible chance of a successful examination and surgery
 - Errors in placement can compromise the procedure
- There is much variation to consider
 - Anatomical variation in joint size, morphology and flexibility
 - Pathological variation in capsule thickness, joint morphology and flexibility
- Minimising variables is the key to getting good ports established

Getting consistent positioning

- There is a steep learning curve in arthroscopy
- Having the patient positioned consistently will help you minimise beginners variation in technique
- You will have to try several positioning techniques first to see what you prefer
- It's worth practicing with different techniques on cadavers
- Limb can be fixed in a brace or left in neutral

Neutral vs Fixed positioning

- | Fixed | Neutral |
|--|--|
| <ul style="list-style-type: none"> Required specialised brace Can be tricky to position some breeds Difficult to rectify positioning problems once scrubbed up Does not allow dynamic assessment of joint Allows consistent positioning Negates need for assistant | <ul style="list-style-type: none"> No specialised equipment Can be used for all breeds Easy to change positioning Allows dynamic joint assessment <ul style="list-style-type: none"> Can help in recognitions of anatomy Positioning is much less consistent An assistant is required Can be quite tiring |

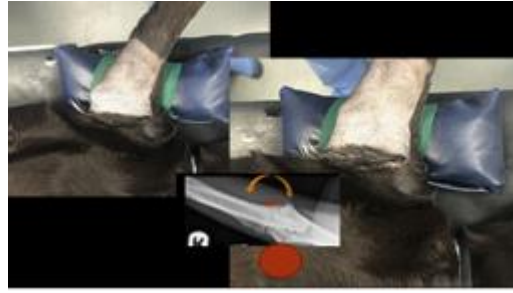
Positioning for arthroscopy of the shoulder

- Neutral is preferred
- An assistant can be used to rotate, extend, flex, abduct or adduct the limb
 - Facilitate port establishment and joint examination
- Generally more lax joint means forces required are much less than elbow
 - Minimal assistant fatigue
- Limb can be free draped or carefully handled through drapes
- Conversion to arthrotomy does not require repositioning
- With bilateral arthroscopy the patient needs to be repositioned between surgeries
 - Care must be taken to preserve sterility of equipment



Positioning for arthroscopy of the elbow

- A brace is recommended when starting out
- Allows generation of valgus force to open medial aspect of joint
- Allows external rotation of manus to also distract humerus and ulna
- In large dogs an assistant may not be able to maintain appropriate positioning for long periods
- Great care must be used to correctly position the limb
 - Poor positioning may injure limb or fail to open joint
- With bilateral arthroscopy the patient needs to be repositioned between surgeries
 - Care must be taken to preserve sterility of equipment
- If using neutral positioning, limb is free draped so whole limb can be handled



- Align shoulder as much as possible
 - If needed, dislocate the joint (not recommended, unless advised)
- Align the lower leg as much as possible
- A moderate amount of force is required
- No evidence of morbidity in this position
 - If needed, dislocate the joint (not recommended, unless advised)
- Proper positioning makes establishing position as much easier







Forthcoming Miniseries on arthroscopy

- Arthroscopy Miniseries Session 2**
 - First steps in arthroscopy
 - Arthroscopic examination of the shoulder and elbow
 - November 7th 1400
- Arthroscopy Miniseries Session 3**
 - Improving your arthroscopy skills
 - Arthroscopic-assisted surgery in elbow and shoulder disease
 - November 14th 1400
