Common Surgical Procedures in Mice and Rats

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https://research.utsa.edu/compliance/larc/training.html

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Procedures in this Presentation

- Partial and total splenectomy (dorsal and ventral approach)
- Ovariectomy
- Ovariohysterectomy
- Orchiectomy (scrotal and abdominal approach)
- Scrotal and abdominal vasectomy
- Adrenalectomy
- Nephrectomy
- Ureter ligation

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Procedures in this Presentation

- Partial hepatectomy in mice (with and without gall bladder removal)
- Subdiaphragmatic vagotomy
- Piloroplasty secondary to subdiaphragmatic vagotomy
- Removal of sciatic nerve section
- Common carotid catheterization
- External jugular vein catheterization
- Femoral artery catheterization
- Femoral vein catheterization

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Disclaimers

1. Images and videos associated with this presentation are for the purpose of demonstration of surgical techniques and are not intended to teach or demonstrate aseptic technique
2. As author of this presentation, I firmly advocate that survival surgery in rodents should be performed with meticulous attention to aseptic technique
3. Procedures shown in this presentation conducted as terminal procedures in anesthetized animals, under a protocol approved by the animal ethics committee at my institution

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Before beginning…

Skin Closure

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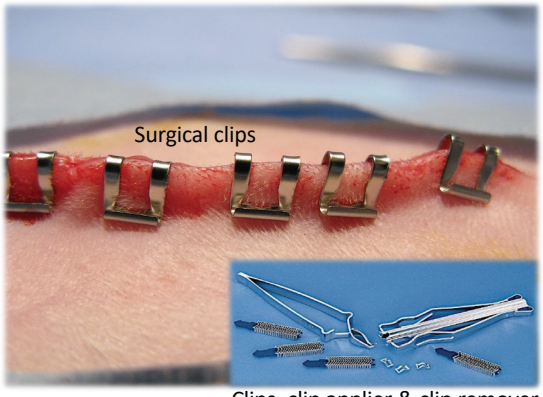

Clips, clip applier & clip remover

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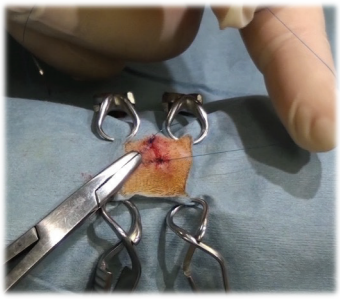
Non absorbable, monofilament suture



Silk is not an appropriate suture for skin closure

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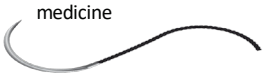
Silk on Skin

- It is easy to handle making it the suture of choice of many investigators… however…
- Should not be used for skin closure for following reasons:
  - Produces undue local reaction and inflammatory response
  - It is braided and through its wicking action serves as a fomite to introduce microorganisms into the wound
  - These properties result in potential clinical and subclinical infections
  - As such, it is not consistent with sound principles of veterinary medicine



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Approaching the Spleen

Dorsal & Ventral Approach

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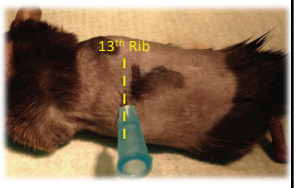
Dorsal Approach

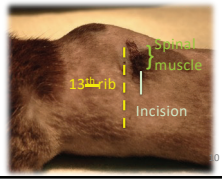
~1 cm skin incision

On animal's left side

Parallel to 13th rib

Dorsal extreme beginning just below the spinal muscle





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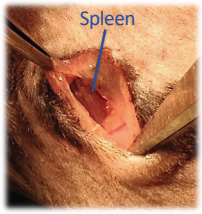
Separate (no need to cut) abdominal muscle fibers with tips of sharp scissors (iris scissors)

Spleen is seen below opening



Exteriorize spleen

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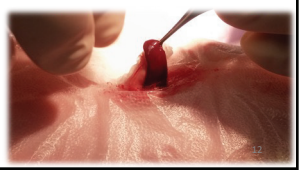
Ventral Approach

- Make a 1-2 cm mid ventral skin incision with its extreme cranial end at the level of the stomach
- Abdomen is entered through the linea alba
- Spleen is identified below and to the left of the linea alba
- Exteriorize spleen



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Partial Splenectomy (Biopsy)

Via a Ventral or Dorsal Approach

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Spleen is accessed via a dorsal or ventral approach

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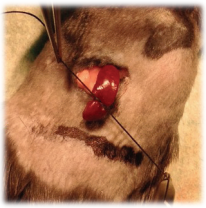
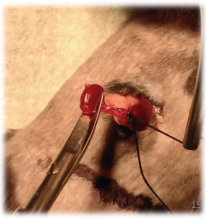
1. Tie a ligature around the spleen arm to stem bleeding

   Do not include splenic vessels into ligature

2. Excise splenic tissue distal to ligature





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Partial Splenectomy (Biopsy) in the Mouse – Video

Ventral Approach

3:08

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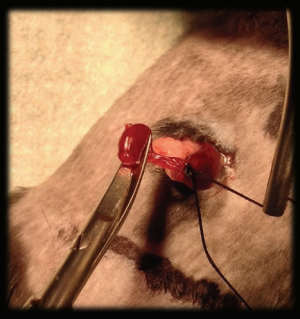
Video – Partial Splenectomy



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Total Splenectomy

Via a Ventral or Dorsal Approach

18

Spleen is accessed via a dorsal or ventral approach

19

1. Exteriorize spleen
2. Cut gastro-splenic ligament with scissors or cautery to separate spleen from stomach
3. Identify, isolate and ligate splenic vessels.
   In tiny mice careful cauterization of vessels without a ligature may be performed with caution

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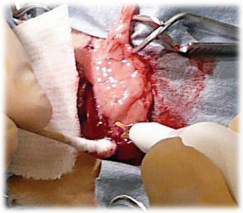
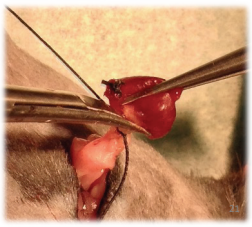
Cauterize or transect blood vessels distal to ligature





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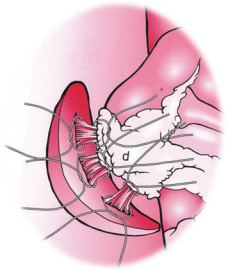

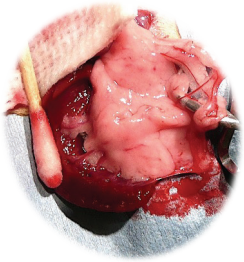

In rats (especially large ones) isolate individual blood vessel bundles and ligate

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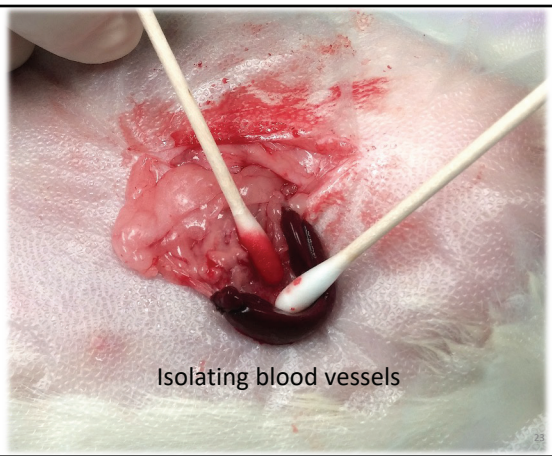

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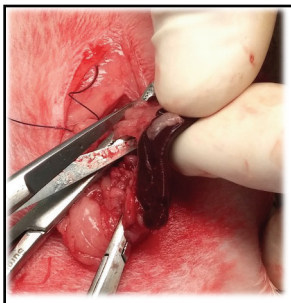

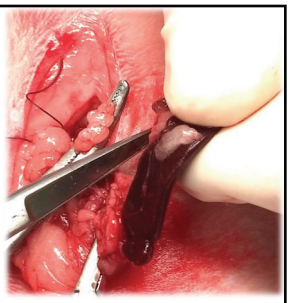

Ligate & Cut

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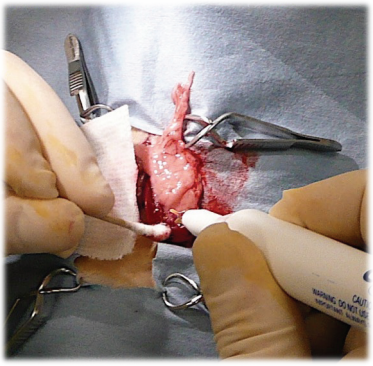

Cautery alone works well in smaller animals (mice)

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- Muscle layer is closed with absorbable suture
- Skin is closed with
  - Monofilament, non-absorbable suture in an interrupted fashion, or
  - Surgical Clips

Surgical skin glue (cyanoacrylate) may be applied to close small skin incisions or to reinforce (and provide a microbial barrier) larger incisions

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Total Splenectomy in the Mouse Video

Ventral Approach

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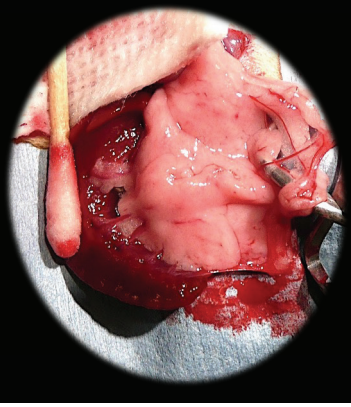
Video – Total Splenectomy



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Ovariectomy

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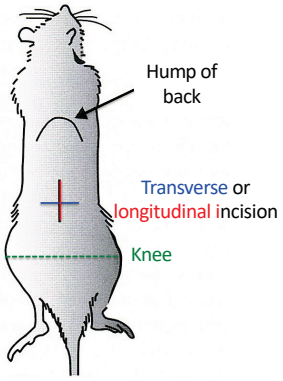

- Make a transverse or longitudinal dorsal incision ~ half distance between hump of back and level of knee with animal in ventral recumbency
- Transverse incision allows easier bilateral access to both ovaries through same incision

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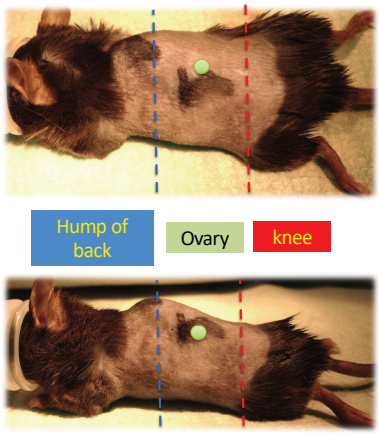

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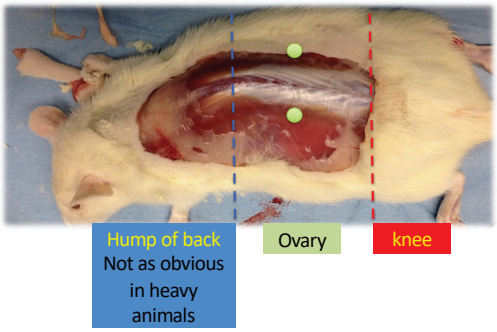

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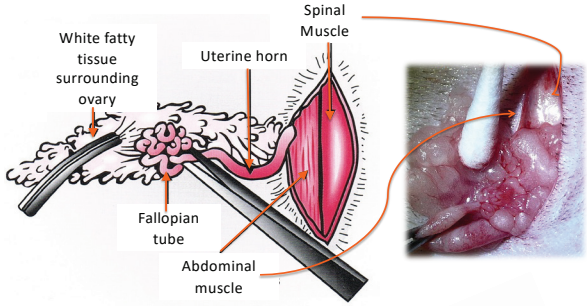

Cut or penetrate and separate abdominal wall muscle fibers with tips of sharp scissors (iris scissors) to locate ovary

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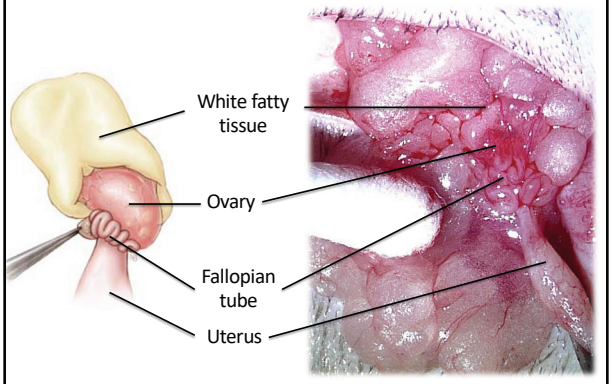

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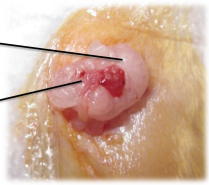
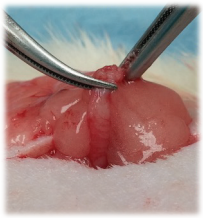
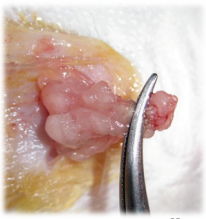
1. Identify white fatty tissue surrounding ovary
2. Identify ovary, fallopian tube under white fatty tissue
3. Retract ovaries with forceps







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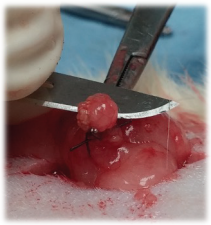
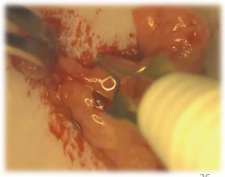
Cut or cauterize to remove ovary

With rats (specially if large) may place a ligature to minimize bleeding





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Alternative to Traditional Cautery

1. Submerge tips of hemostatic forceps in a hot bead sterilizer
2. Remove and immediately clamp tissue

37

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- Muscle layer is closed with absorbable suture
- Skin is closed with
  - Monofilament, non-absorbable suture in an interrupted fashion, or
  - Surgical Clips

Surgical skin glue (cyanoacrylate) may be applied to close small skin incisions or to reinforce (and provide a microbial barrier) larger incisions

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Mouse Ovariectomy Video

1:55

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Video – Ovariectomy

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Ovariohysterectomy

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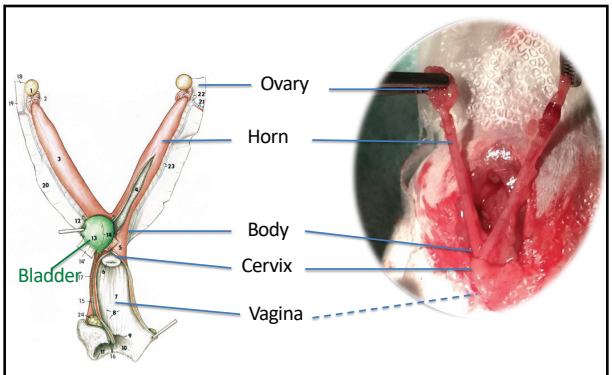

Mouse & rat female reproductive track

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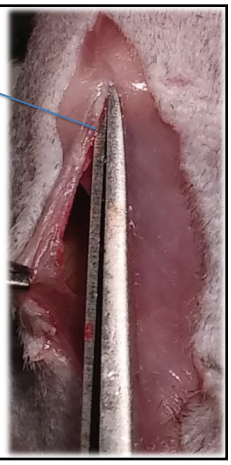

1. Make a ventral midline skin incision with its extreme caudal end at level of the pubis (bladder)
2. To enter abdomen, linea alba is incised in same direction as skin incision

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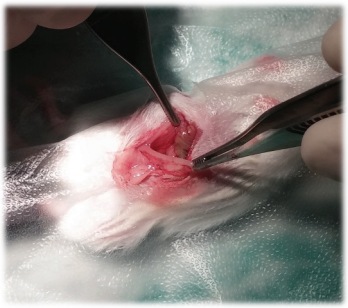

- Exteriorize uterus with its surrounding fat & tissues
  - If necessary move bladder to the side or empty it with a syringe & needle
- Identify uterine body, horns and ovaries

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- Ovaries, uterine horns and uterine body are dissected free to separate from other tissues. In large rats, a ligature distal to ovary minimizes bleeding
- Cautery is useful to dissect tissues away from uterus

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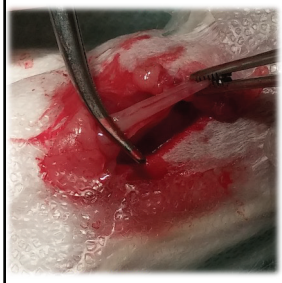
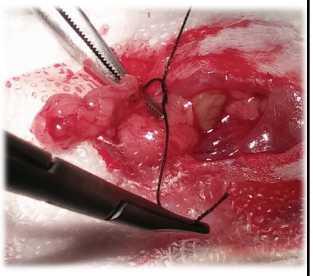


Clamp uterine body or cervix with hemostatic forceps



Place a ligature distal to hemostatic forceps

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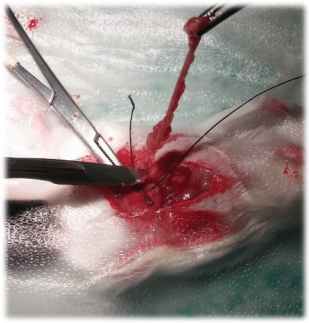

Remove (excise) uterus along with ovaries proximal to hemostats with cautery, surgical blade or scissors

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- Muscle layer is closed with absorbable suture
- Skin is closed with
  - Monofilament, non-absorbable suture in an interrupted fashion, or
  - Surgical Clips

Surgical skin glue (cyanoacrylate) may be applied to close small skin incisions or to reinforce (and provide a microbial barrier) larger incisions

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Mouse Ovariohysterectomy Video

1:58

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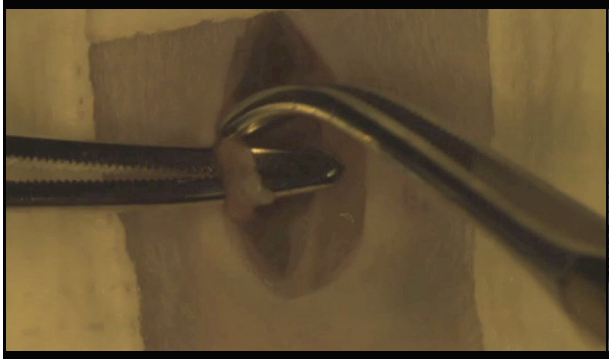
Video – Ovariohysterectomy



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Scrotal Orchiectomy

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- Rats & mice have open (loose) inguinal canals. This allows free movement of testes between scrotum and abdomen
- During scrotal castration, testes may need to be forced into scrotum. This may be done by exerting pressure on testes towards the scrotum in the caudal abdomen with fingers or Q-tips

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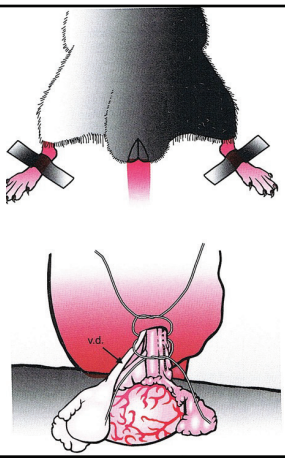

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Incise scrotum on midline

Incise parietal tunica, avoiding cutting the vaginal tunica, which is intimately associated with & adhered to the testes

In mice, use scissors

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A firm tug exteriorizes the testes

Pull until spermatic cord is exposed

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Procedure is similar in mice & rats

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Cauterize or ligate spermatic cord

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Alternative to Standard Cauterization

1. Submerge hemostats in a hot bead sterilizer
2. Immediately clamp to seal and transect the spermatic cord

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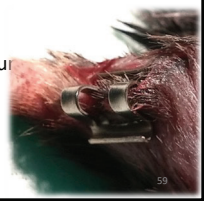
Repeat procedure on contralateral testis

Close scrotum (options)

- Monofilament, non-absorbable sutu in an interrupted fashion
- Surgical Clips
- Surgical glue



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[Orchiectomy Video, Scrotal Approach]

2:44

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Video – Scrotal Orchiectomy

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Abdominal Orchiectomy

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- Rats and mice have open inguinal canals, allowing free movement of testes between scrotum and abdomen
- Testis may need to be pushed from scrotum to lower abdomen towards. This may be done by exerting pressure on scrotum towards abdomen with fingers or Q-tips

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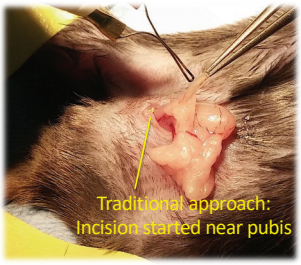

- The traditional abdominal castration makes a ventral midline incision close to the pubis, which can damage seminal vesicles while testis are being searched
- Suggested is a refinement to this technique in next slide

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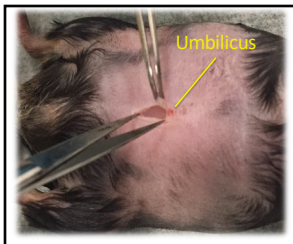

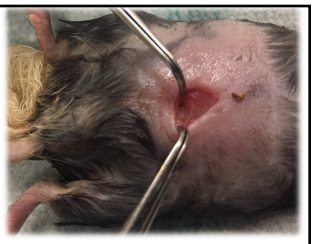

- A refined approach consists of making a ventral midline skin and muscle incision, starting at umbilicus & continuing caudally for a few millimeters
- Testis are pulled out through the incision and removal is performed as described under the scrotal orchiectomy

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Exteriorize whitish fat that is related to the testis

Pull this fat along with testis

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Clamp below the testis ensuring no testicular tissue is trapped in the clamp

Cauterize between the testis & clamp

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- Replace excess tissue back into abdomen
- Muscle layer is closed with absorbable suture
- Skin is closed with
  - Monofilament, non-absorbable suture in an interrupted fashion, or
  - Surgical Clips
  - Surgical skin glue (cyanoacrylate), which provides a microbial barrier

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Vasectomy – Vas Deferens

Abdominal or Scrotal

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Testis is exteriorized through the incision and closure as described under scrotal and abdominal orchiectomy

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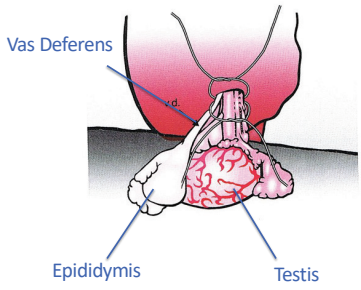

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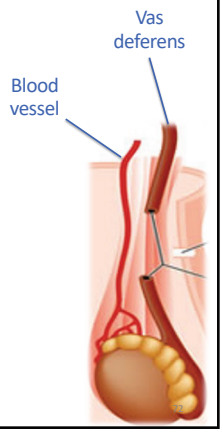
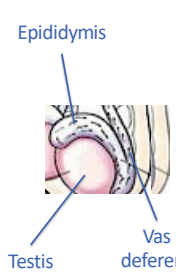
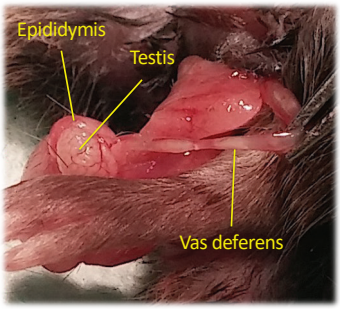
- Vas deferens is relatively massive and easily visualized as a white/bright tubular structure with a blood vessel running alongside it
- Vas is also recognized as continuation of the epididymis
- Dissect out/isolate the vas deferens



72





Vas deferens is relatively massive and easily visualized as a white/bright tubular structure associated with the epididymis

73

73

Excise ~0.5 cm section of each vas deferens with a blade, scissors or cautery with or without suture ligation

74

74

Vasectomy Video in the Mouse

2:15

75

75

Video – Vasectomía del Ratón

76

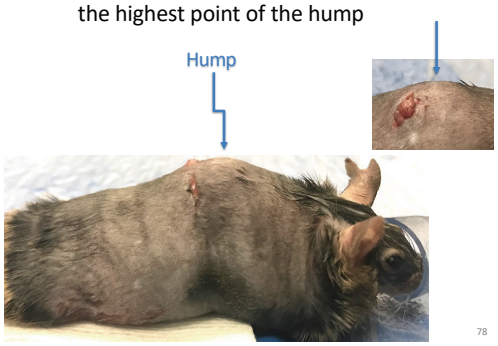
76

Adrenalectomy

77

77

Make a transverse incision on the dorsal skin or 2 incisions on each side of the spine immediately lateral to the spinal muscles. The incision(s) is(are) approximately 4 mm caudal to the highest point of the hump



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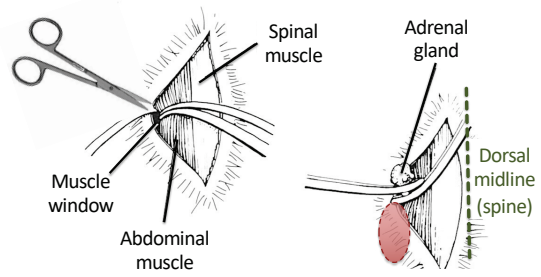
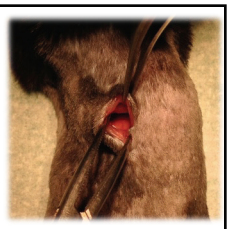


A window is made through muscle fibers by entering muscle and separating fibers bluntly with sharp (iris) scissors

79

79

- Adrenal gland is located cranial and medial to kidney, embedded in fatty tissue
- Be careful not to penetrate the diaphragm at this point, which will result in immediate death
- Remove the gland intact with forceps without needing to cut



80

80

The gland may appear a bit darker in some strains than what is seen in this image

- Muscle layer is closed with absorbable suture
- Skin is closed with
  - Monofilament, non-absorbable suture, or
  - Surgical clips

81

81

Nephrectomy

82

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- Adrenal gland is closely associated (medial and cranial to kidney) with the kidney and should not be extracted or damaged during nephrectomy
- Adrenal gland is left intact in the body

83

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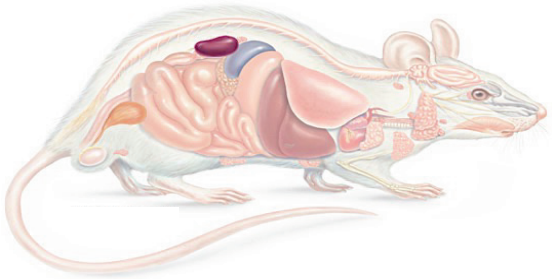
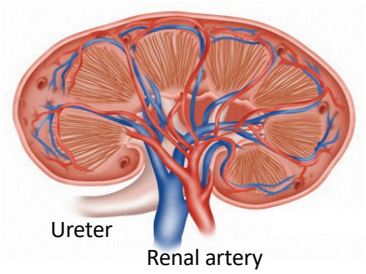


- Right kidney is slightly cranial to the left kidney
- Right kidney is partially hidden under the right lobe of the liver
- Left side nephrectomy is often the preferred approach for unilateral nephrectomy

84

84

Tail



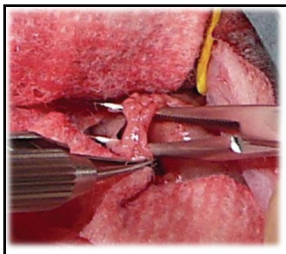
Head

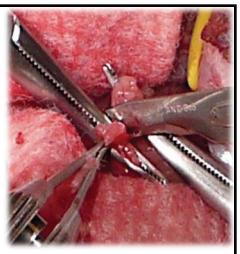
Ureter

Renal artery & vein

85

85

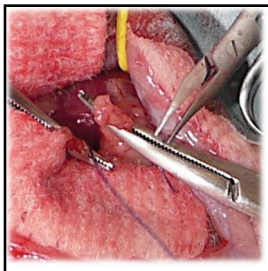


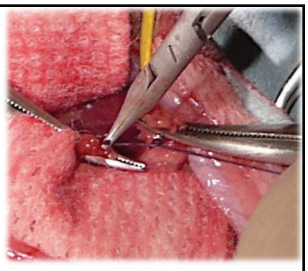


Renal vessels and ureter are isolated

86

86





Ligate with 1 or 2 sutures and remove kidney

Second ligature more important the larger the animal is

87

87

- Muscle layer is closed with absorbable suture
- Skin is closed with
  - Monofilament, non-absorbable suture in an interrupted fashion, or
  - Surgical Clips

Surgical skin glue (cyanoacrylate) may be applied to close small skin incisions or to reinforce (and provide a microbial barrier) larger incisions

88

88

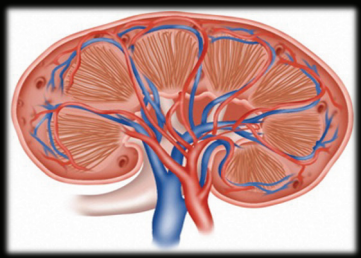
Nephrectomy Video

2:29

89

89

Video – Nephrectomy



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Ureter Ligation

To simulate unilateral obstructive nephropathy

91

The kidney is exteriorized as described under nephrectomy session

92

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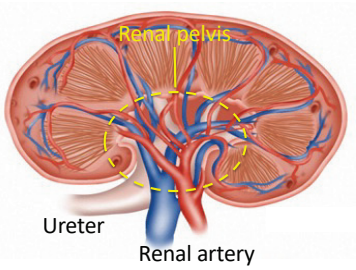

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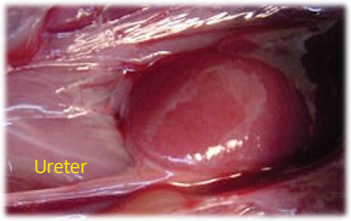

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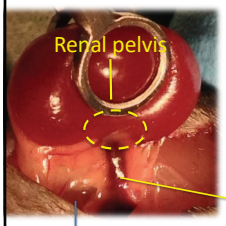
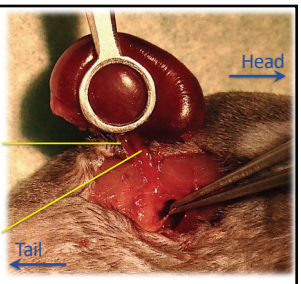


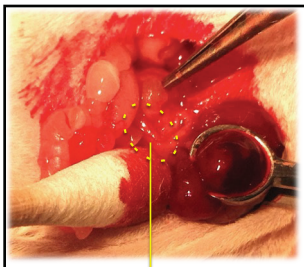


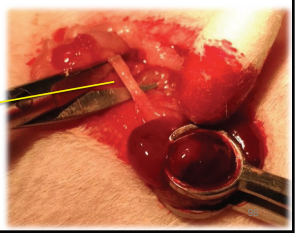
Due to its translucid nature, ureter may be difficult to visualize

Ureter is localized as it leaves the renal pelvis posterior (caudal) to renal artery and vein

95

95





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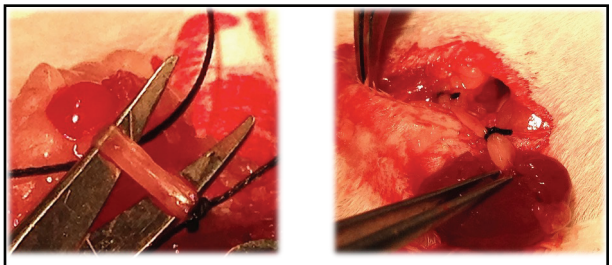


Ureter is ligated with 1 or 2 ligatures or with vessel clamps (for temporary occlusion) to simulate obstructive nephropathy

97

97

- Muscle layer is closed with absorbable suture
- Skin is closed with
  - Monofilament, non-absorbable suture in an interrupted fashion, or
  - Surgical Clips

Surgical skin glue (cyanoacrylate) may be applied to close small skin incisions or to reinforce (and provide a microbial barrier) larger incisions

98

98

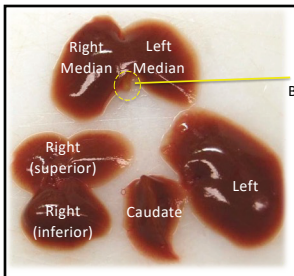
$^{2}/_{3}$ Partial Hepatectomy in Mice

Two Methods

99

Liver Anatomy

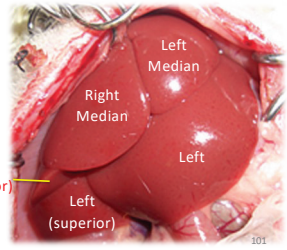
100



Liver Lobes

Why is this a mouse & not a rat liver?

Rats lack a gall bladder



101

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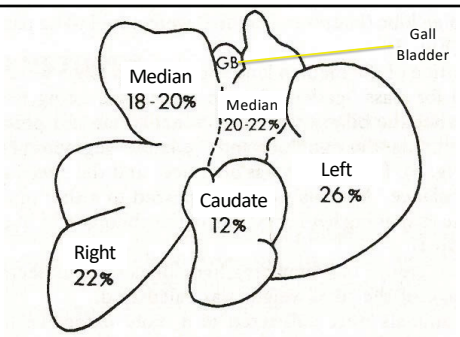


- In most strains of mice the relative weights of the respective lobes are constant
- Anatomy similar in rats, except rats lack a gall bladder

102

102

- Mammals can survive removal of up to 75% of total liver mass
- If > 75% is removed, remaining liver mass is not sufficient to maintain critical levels of blood glucose
- Removal of <1/3 will not elicit a generalized liver proliferative response
- Therefore, median and left lobe hepatectomy is considered ideal and results in removal of ~ 64-68% of total liver mass, a partial hepatectomy technique known as ***2/3 Hepatectomy***
- After resection of 2/3 of the liver, remaining hepatocytes undergo one or two replication rounds without complications related to hypoglycemia
- ***2/3 hepatectomy*** is therefore a preferred method for studying dynamics of liver regeneration

103

103

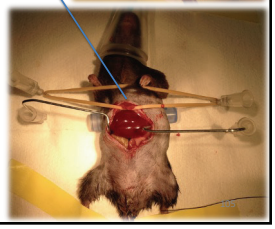
Surgical Technique

104

- Dorsal pressure helps with liver exposure

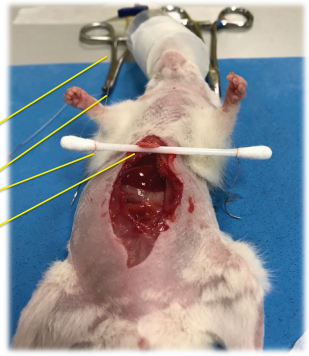
Paper clip

Xiphoid process



- Recommended retraction to expose liver with paper clips, rubber band and needles
- Midline incision is extended beyond (cranial to) xiphoid process
- Xiphoid process is retracted with rubber band to further expose liver

105



Alternative Xyphoid Lifting

106

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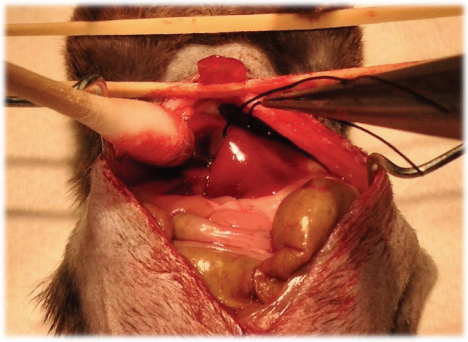
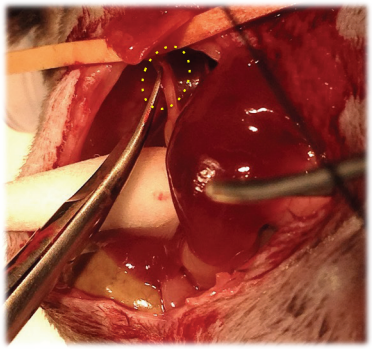


Q-tips soaked in saline are useful tools for moving lobes

107

107



Before placing ligatures at the base of the lobes, cut various ligaments as illustrated here in the middle lobe

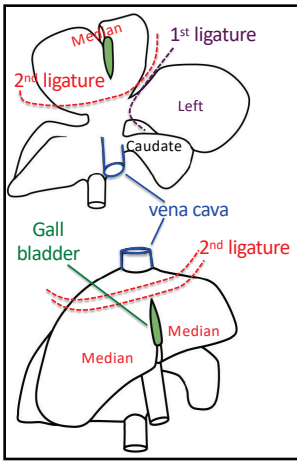
108

108

Partial Hepatectomy – Method #1

Two **ligating sutures**
Gall Bladder Removed

109

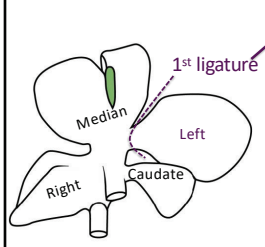


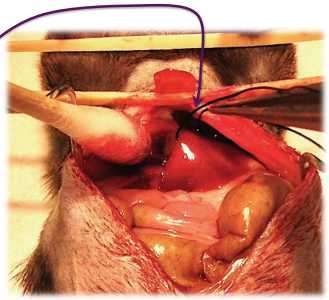
- Gall bladder is removed with median lobe
- This technique should not be used in C57 mice, as it may result in death in 7 days or less

- 1st ligature placed at base of left lobe
- 2nd ligature placed somewhere between the 2 dashed lines
- Ligating too too close to vena cava, may result in stenosis of the vena cava

110

110





1st ligature placed at base left lobe

111

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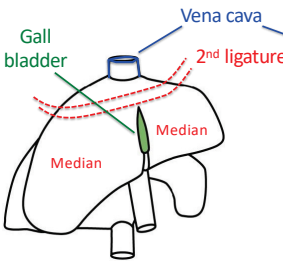
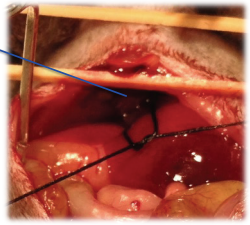


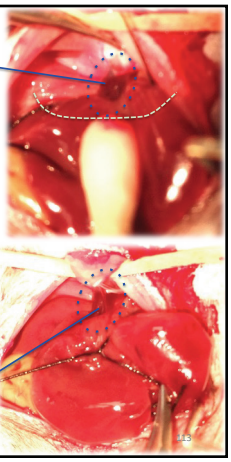


- 2nd ligature, on right & left median lobules include gall bladder

- 2nd ligature placed between 2 dashed lines
- Ligating too too close to vena cava, may result in vena cava stenosis

112

112



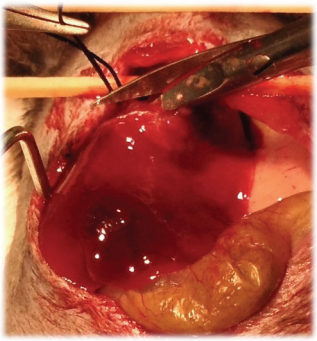
Vena cava is observed at base of median lobe

Visualizing vena cava in method #1 is key to avoid placing ligature to close to it and to avoid vena cava stenosis

113

113

After ligation use sharp scissors to excise (remove) liver lobe distal to ligature



114

114

Partial Hepatectomy Video
Method #1, Gall Bladder Removed

3:48

115

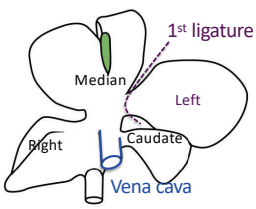
Video – Partial Hepatectomy

116

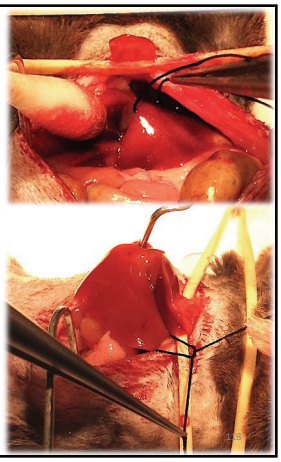
Partial Hepatectomy – Method #2

Three **ligating sutures**
Gall Bladder Left in Place

117



1st ligature at base of left lobe



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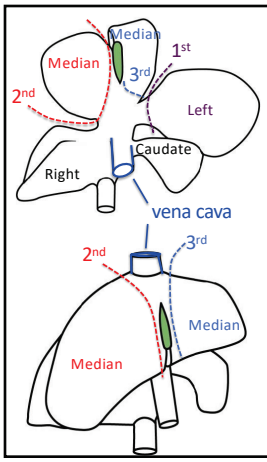
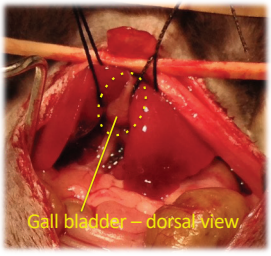


- 2nd ligature around base of right median lobe
- 3rd ligature around base of left median lobe



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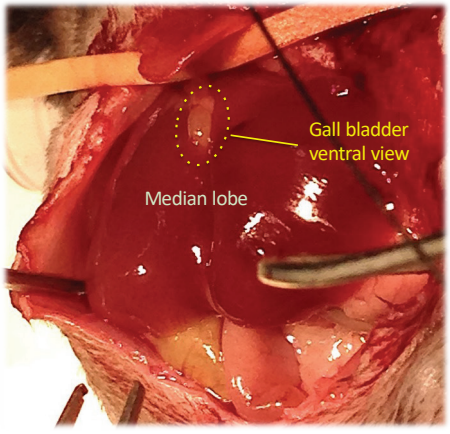
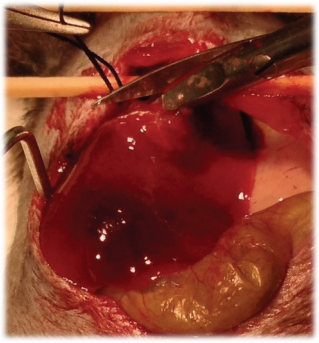


120

After ligation, distal to ligatures, lobes are excised with sharp scissors



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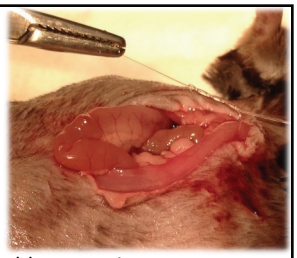


- Muscle layer (linea alba) is closed with absorbable suture
- Skin is closed with
  - Monofilament, non-absorbable suture in an interrupted fashion, or
  - Surgical Clips

Surgical skin glue (cyanoacrylate) may be applied to reinforce closure (and provide a microbial barrier)

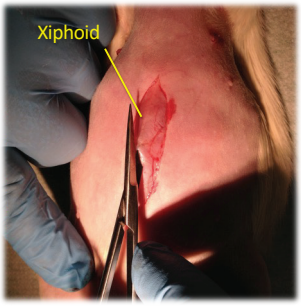
122

122

Subdiaphragmatic Vagotomy

123

123



- A mid-ventral skin incision is made with its extreme cranial end at the level of xiphoid process
- Abdomen is entered through linea alba in same direction as skin incision

124

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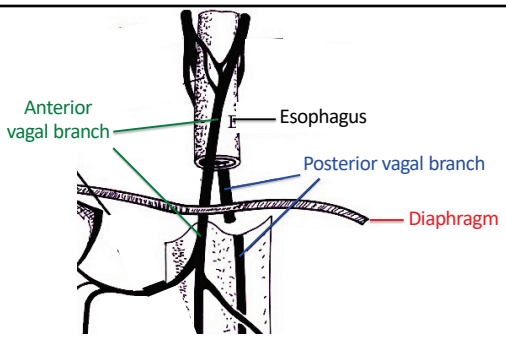
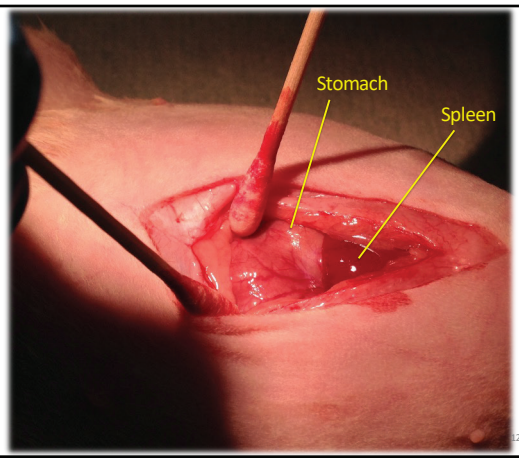


Both anterior and posterior branches of the vagus nerve are excised

125

125



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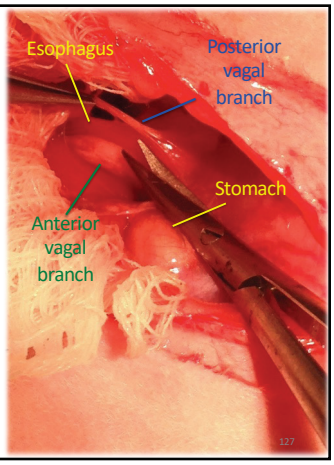
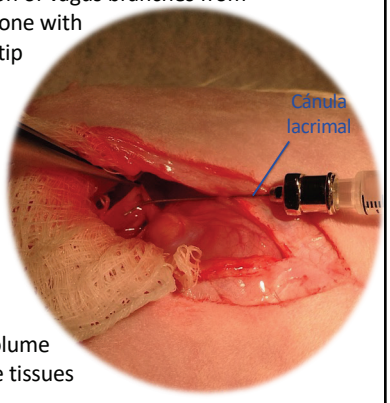
- Esophagus & both branches of vagus (anterior & posterior) are identified caudal to diaphragm
- With delicate blunt dissection separate both vagal branches away from esophagus



127

127

- Dissection/separation of vagus branches from esophagus can be done with micro-scissors, fine tip forceps or by hydrodissection
- Hydrodissection is done by inserting a lacrimal cannula attached to a 1 ml syringe between esophagus & vagus branch, followed by injection of small volume of saline to separate tissues



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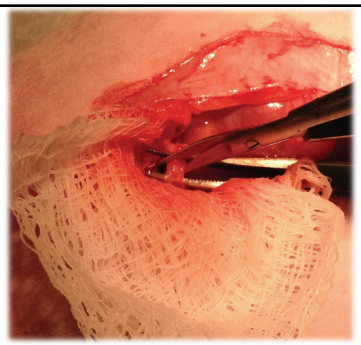

Each vagal branch is individually cut or ligated depending on study objectives

Vagotomy in mice requires high magnification

129

129

Pyloroplasty as Adjunct Surgery to Subdiaphragmatic Vagotomy

130

130

The Problem and the Solution

- The pyloric sphincter controls output of food from the stomach into the duodenum
- Problem: Vagotomy results in pylorus inability to allow stomach emptying into duodenum
- Solution: Pyloroplasty widens the pylorus to allow passage of food into the duodenum

131

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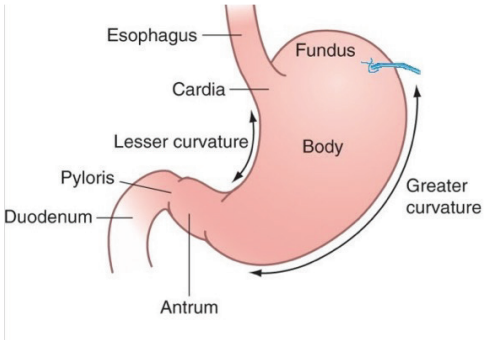

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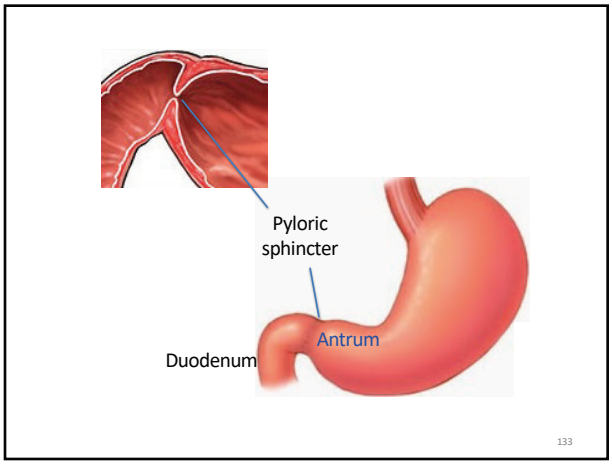

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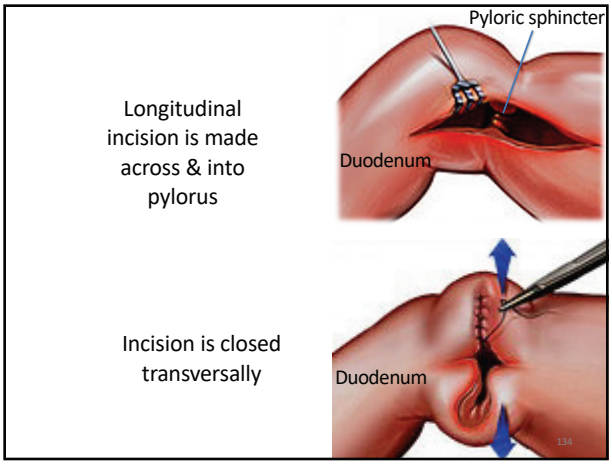


134

Results

Before pyloroplasty

After pyloroplasty

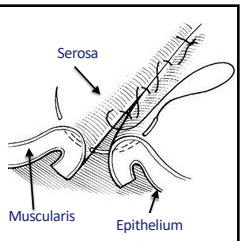
Emptying of stomach is now possible

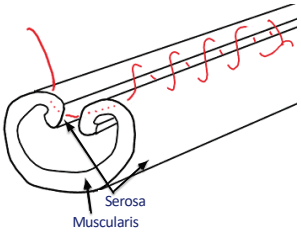
135

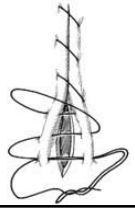
135

Suture technique of pyloric incision method #1:

- Suture: Monofilament, absorbable
- Layers: 1 layer-closure, inverted
- Instruments: Microsurgical







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136

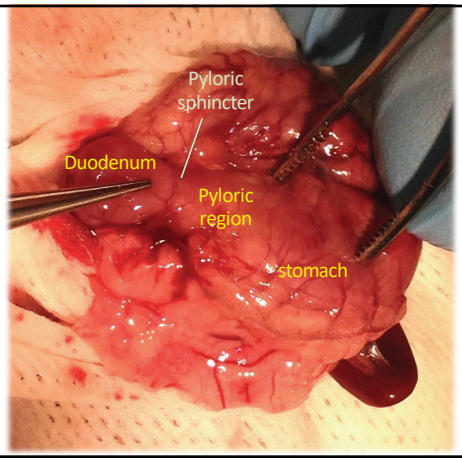
Suture technique of pyloric incision method #2 (preferred):

- Suture: Monofilament, absorbable
- Layers: 1 layer-closure, inverted
- Instruments: Microsurgical

Horizontal mattress pattern

137

137



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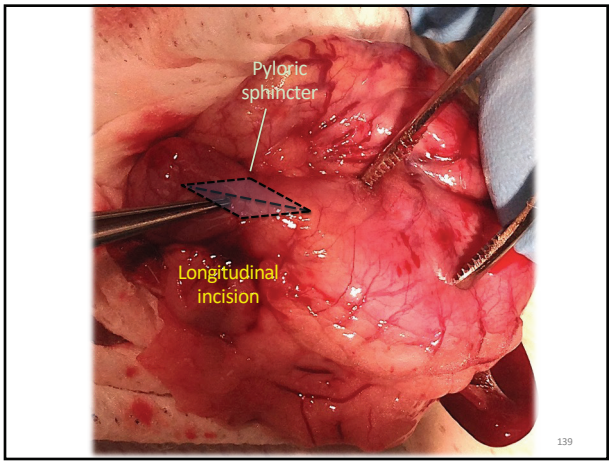

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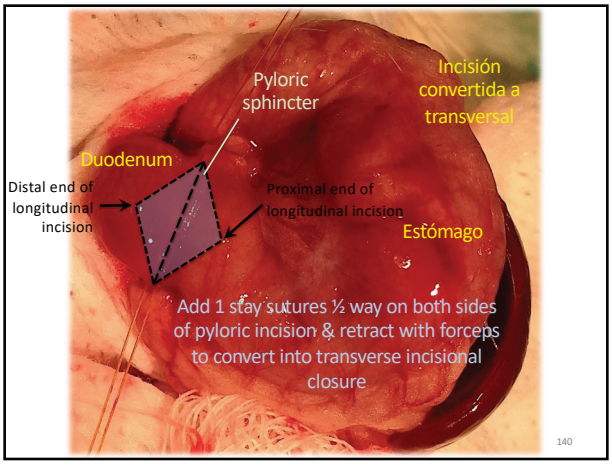

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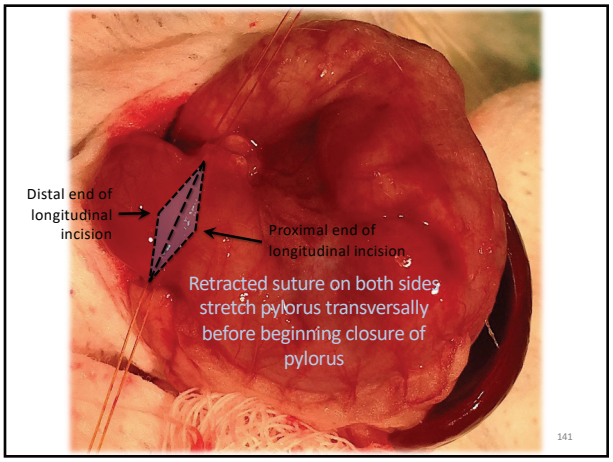

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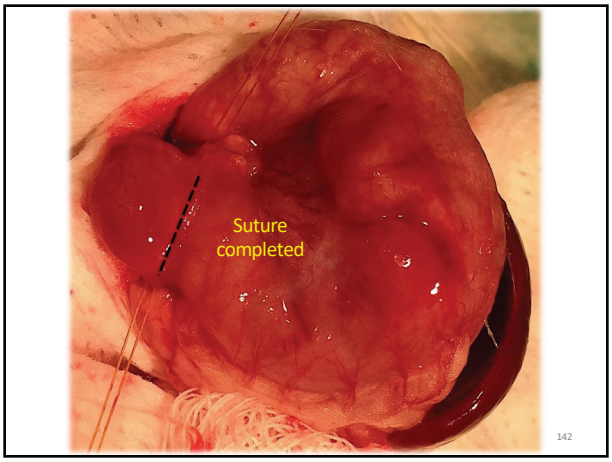

142

Sciatic Nerve Excision

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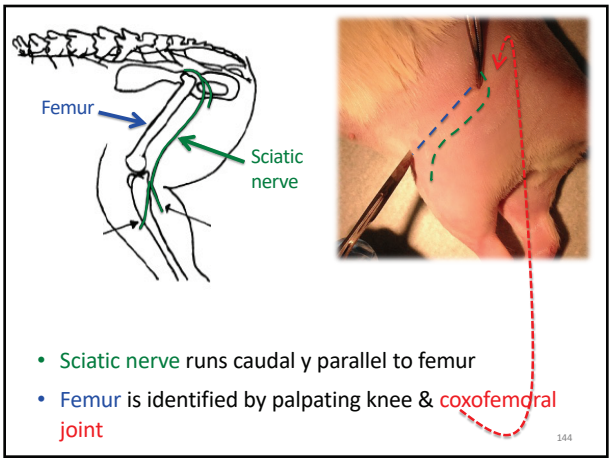
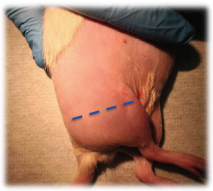


144

- Longitudinal incision:
  - ~3-5 mm caudal to femur
  - Most proximal end at level of coxofemoral joint (or greater trochanter)
- Bluntly dissect through intermuscular white band



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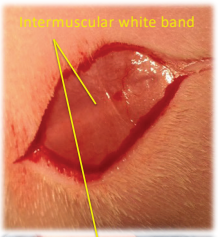
With sharp pointed scissors (e.g., iris scissors) penetrate white fibrous band, separating muscle bellies without cutting muscle

Continue separation & dissection until white sciatic nerve becomes visible



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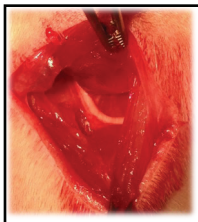

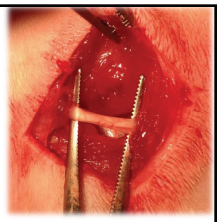

- Dissect & elevate sciatic nerve with fine mosquito hemostats
- Cut sciatic nerve
- Approximate muscles with absorbable suture in a simple continuous pattern
- Close skin with clips or non absorbable, monofilament interrupted suture

147

147

Common Carotid Cannulation

This method is used to introduce catheter or telemetry device into artery

148

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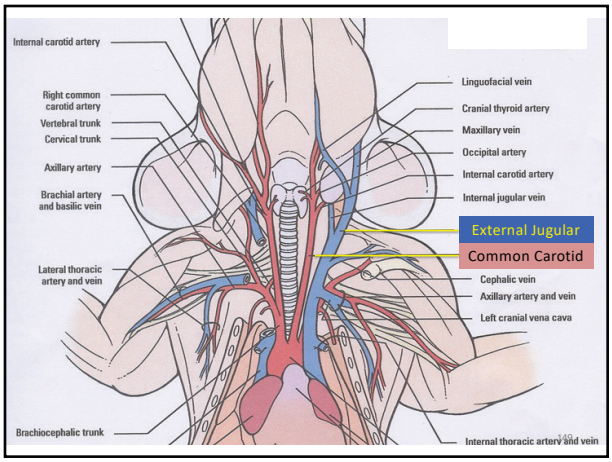

149

149

Place a syringe hub or similar object (size depends on animal size) under neck to help expose the blood vessel

150

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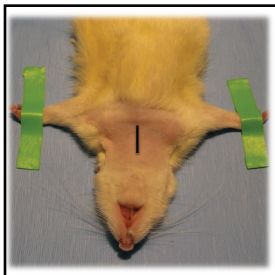

- Surgeon position is cranial to nose or caudal to animal depending on surgeon's preference (I prefer cranial to nose)
- Make a ~2-3 cm mid ventral incision over trachea (or just lateral to it)

151

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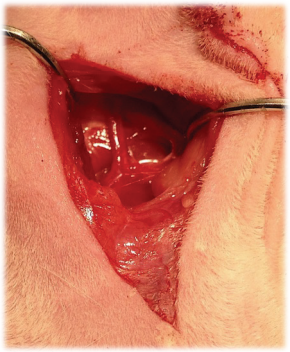
Heart

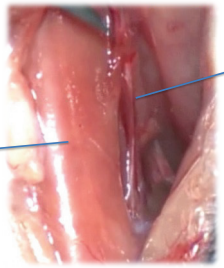


Head

152

152

Common carotid is identified after separating muscles that run parallel to trachea



Animal's head

153

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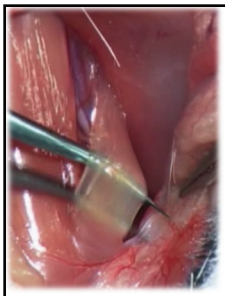

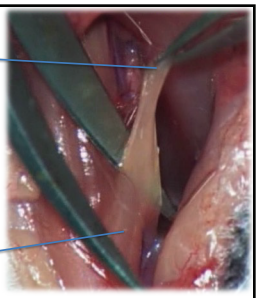

Removal of this muscle facilitates access to carotid. With greater experience, this muscle may be left intact

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- When arteries are manipulated, they easily go into spasm and collapse, complicating the introduction of the catheter (cannula) into the artery
- Suggestions to minimize spasm & collapse
  1. Prevent the artery from drying ... Keep moist with warm saline at all times
  2. Minimize handling the artery ... If manipulating artery is necessary, grasp the tissue adjacent or above the artery rather than the artery itself
  3. 1-2 drops of 2% lidocaine over artery helps minimize spams

155

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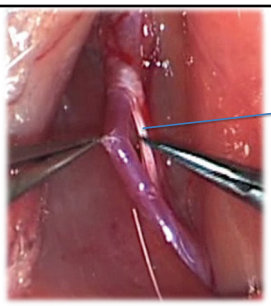

- Artery is carefully separated from vagus nerve
- Avoid damaging recurrent laryngeal nerve, which runs along side the trachea (medial to carotid & vagus)
- Note in image above: Great care is taken to minimize grasping artery, but rather grasp tissue surrounding it

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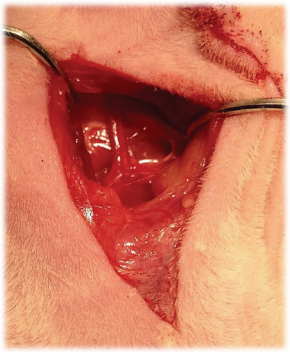
Heart



Head

157

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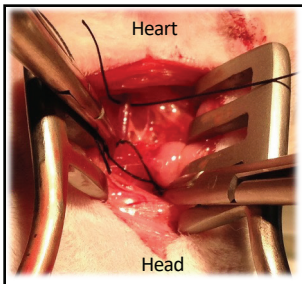

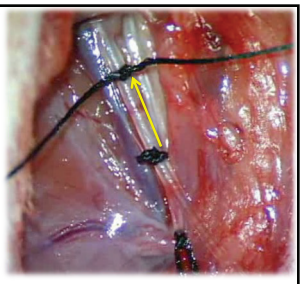

- Place 2 ligatures distal & proximal to where catheter will be introduced. 3 ligatures can be placed for added security
- Distal suture (towards head) is tightened to ligate artery
- Proximal suture (towards heart) is kept lose

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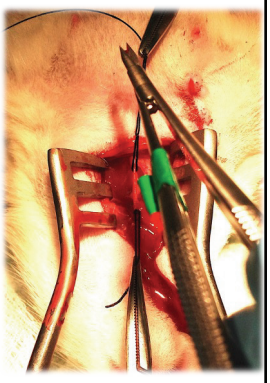
With forceps place tension on proximal suture (closest to heart) to kink artery

This avoids excessive bleeding when artery is entered (incised)

Heart



Head

159

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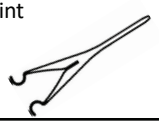
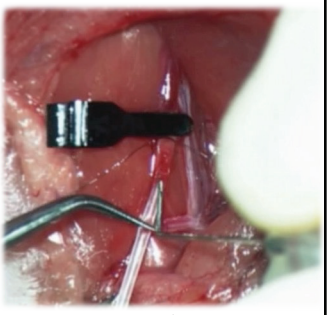
Alternative to kinking:

Artery can be occluded with vascular clamps proximal (closer to heart) to artery incision point



Heart



Head

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- ~50% of artery's diameter is incised
- Arterial incision should be made close to distal suture (closest to head)

Heart

Head

161

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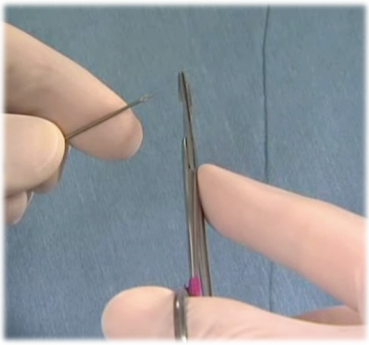


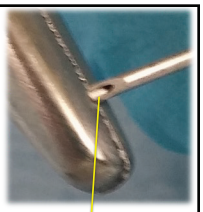
Suggestion to create a catheter introducer

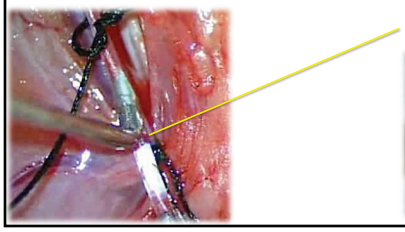
162

162

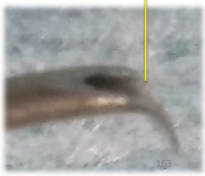
Suggestion to create a catheter introducer:

- With needle driver, bend hypodermic needle at 90-120^0 as illustrated 2 images on right
- This creates a channel to help slide catheter under cut lumen of the needle point
- Point of needle penetrates blood vessel & catheter is introduced under needle





Catheter insertion site



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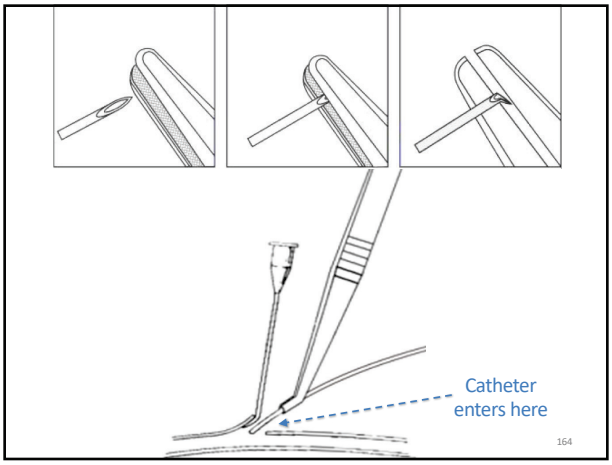

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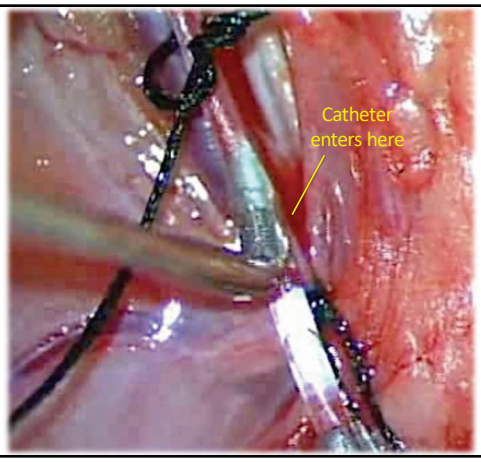

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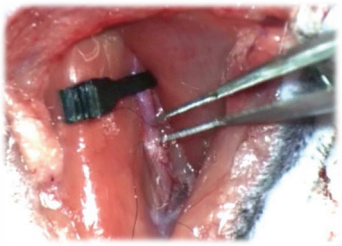

Instead of kinking artery with proximal suture (closest to heart), artery occlusion can be made with a vascular clamp

This prevents excessive bleeding when artery is incised

166

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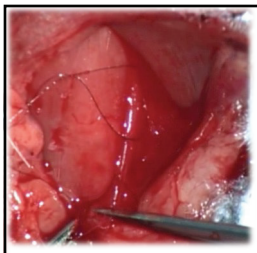
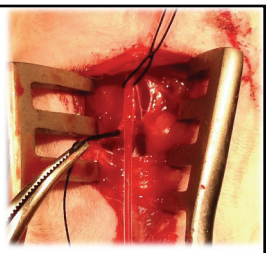
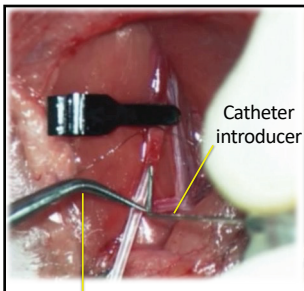


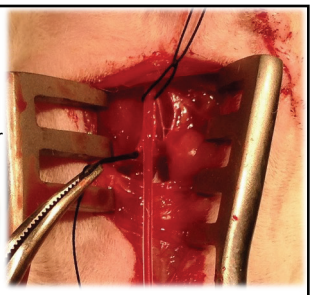


Although using either method will lead to some bleeding, use of vascular clamps will lead to less bleeding

167

167





Catheter is inserted directing towards the heart

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Suggestion: Catheter forceps (with internal grooves) are useful tools to grasp & introduce catheter into artery or vein, while minimizing damage to catheter

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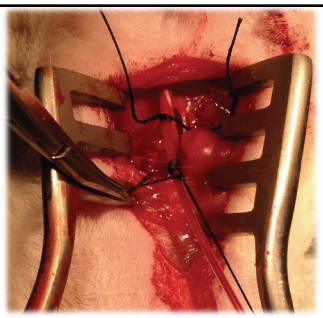

- After introducing catheter, tie proximal suture over artery and catheter
- Tie distal suture around exteriorized catheter

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Common Carotid Artery Catheterization Video

4:24

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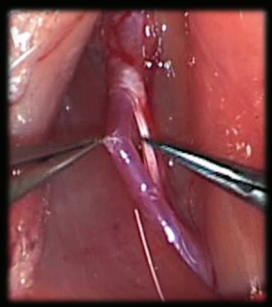
Common Carotid Artery Catheterization Video



173

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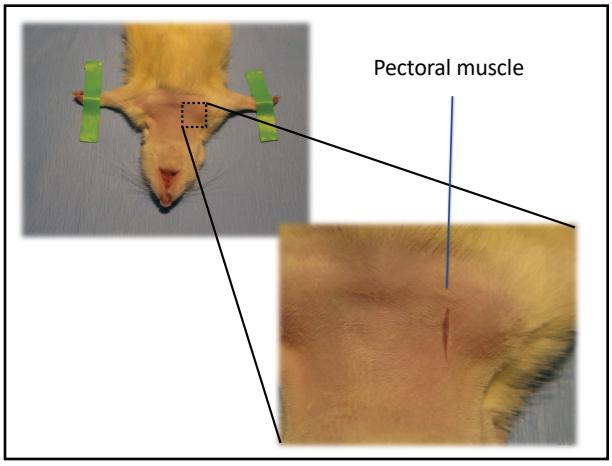
External Jugular Vein Catheterization

174

174



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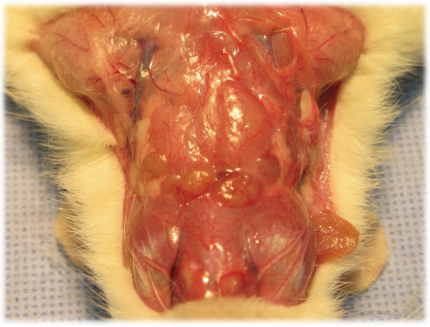
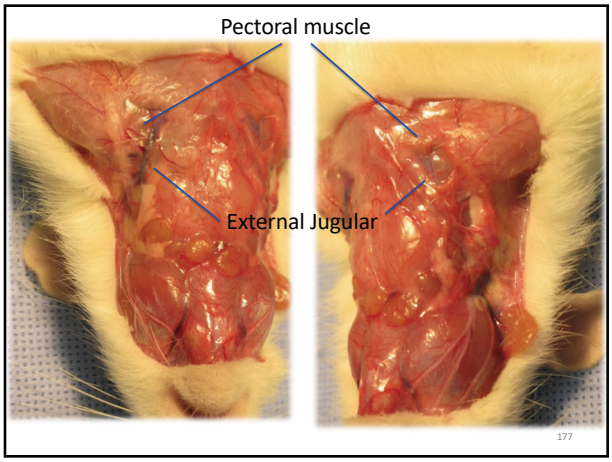


External jugular is visualized as it disappears under pectoral muscle

176

176

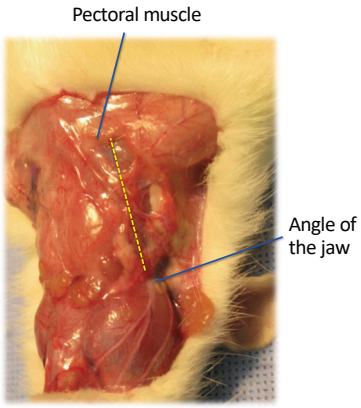


177

177

Skin incision points of reference:

Direction of skin incision will be a straight line somewhere between pectoral muscle & a point just (slightly) medial to the angle of the jaw

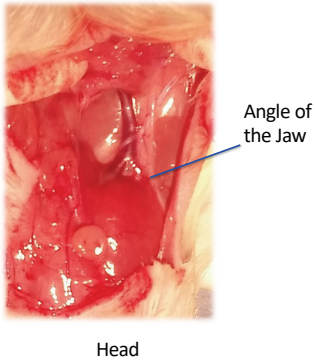


178

178

Skin incision points of reference:

Direction of incision will be a straight line somewhere between pectoral muscle & a point just (slightly) medial to the angle of the jaw



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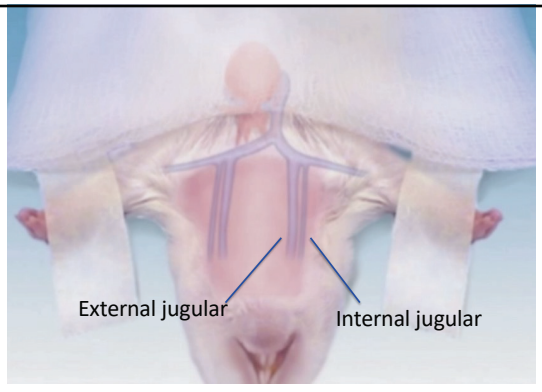
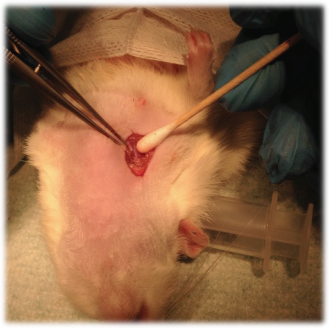


Note: Orientation of jugulars is not exact. Cartoon is for illustration purposes and not to describe exact anatomical landmarks

180

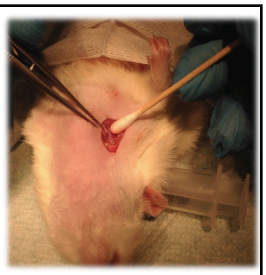
180



Place a syringe hub or similar object (size depends on animal size) under neck to help expose the blood vessel

181

181



- Surgeon position is cranial to nose
- Make a 1.5-2.5 cm incision
- Incision started at level of pectoral muscle & directed towards angle of jaw (or slightly medial to it)

182

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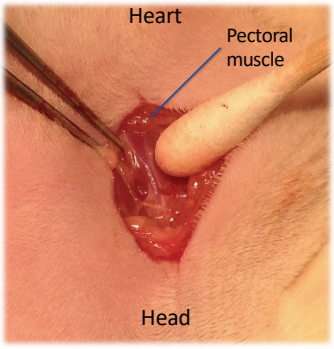

Once located, dissect external jugular free of surrounding tissue

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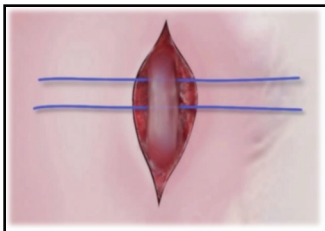
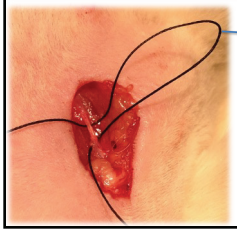


Place 2 sutures under vein



Cut here

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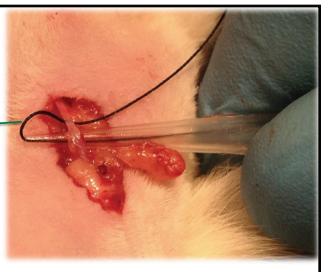
Suggestion for passing suture under blood vessel

Grasp suture here (this is the "other" side)



- Insert suture through hub of small/sterile pipette
- Force tip of pipette under vessel while rotating pipette back & forth about its longitudinal axis
- Once through the "other" side, grasp suture with forceps
- While grasping suture on "other" side, remove pipette & leave suture in place

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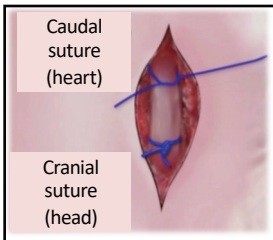

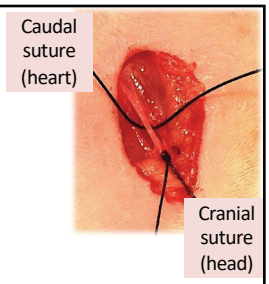

- Most cranial (towards head) ligature is tied and knotted
- Most caudal (towards heart) ligature is left loose without tying (for now)

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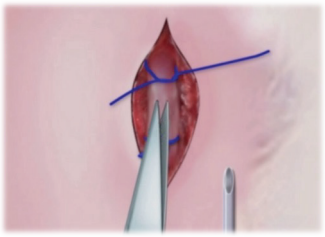

~25% of vein's diameter is incised

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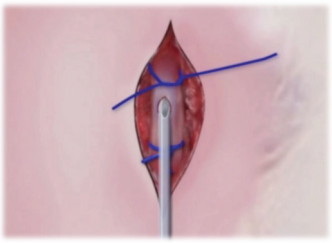

Catheter is introduced directed towards (in the direction of) the heart

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- After introducing catheter, tie caudal (towards heart) suture over vein and catheter
- Tie cranial (towards head) suture around exteriorized catheter

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External Jugular Catheterization Video

6:41

190

190

External Jugular Catheterization Video

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Femoral Artery and Vein Catheterization

192

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- Femoral Vein & Artery catheterization is performed following the same principles discussed earlier in this presentation for the common carotid and external jugular sections
- The difference is how to approach & manipulate the femoral vessels. See following slides for description of these differences
- Femoral Vein, Artery & Nerve run adjacent and parallel to each other. Their orientation from posterior to anterior they run in this order, VAN (Vein, Artery & Nerve)

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- Incision is made longitudinal or perpendicular to the femoral furrow according to the surgeon's preference
- Incision is made on the medial surface of the thigh over the areas traversed by the femoral Vein, Artery & Nerve, with its most extreme cranial end (if incision is longitudinal) at the level of the inguinal ligament

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Immediately after making the incision, a body of fat (fat pad) is encountered, which is retracted away or excised to visualize femoral Vein, Artery & Nerve lying right underneath this body of fat

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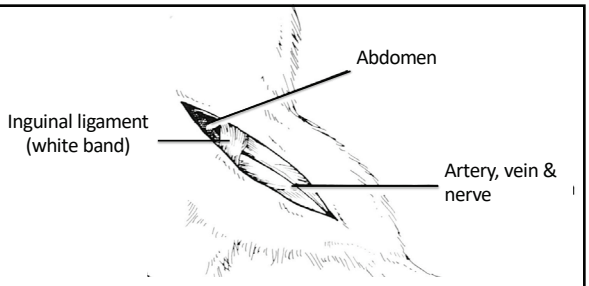

- Incision should expose inguinal area, evident by visualization of a white band of tissue (inguinal ligament)
- Vein, Artery & Nerve disappear proximally under the inguinal ligament as they enter into the abdominal cavity

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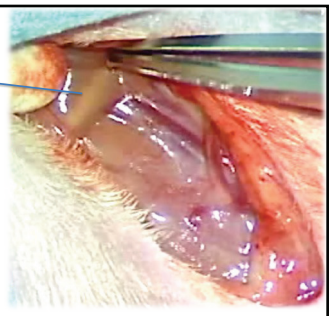

- Incision should expose inguinal area, evident by visualizing a white band of tissue (inguinal ligament)
- Vein, Artery & Nerve disappear proximally under the inguinal ligament as they enter the abdominal cavity

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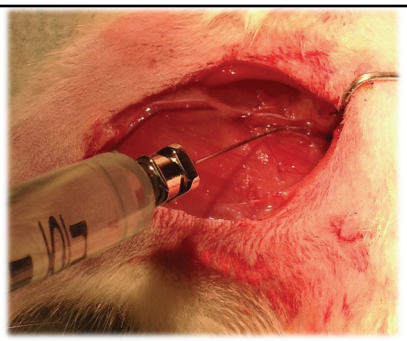

Separation of Vein, Artery & Nerve can be done with micro-scissors, fine tip forceps or hydrodissection

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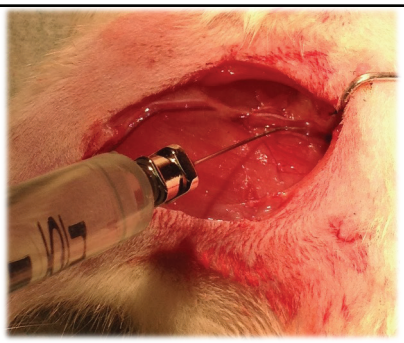

Hydrodissection is performed by inserting a lacrimal cannula attached to a 1 ml syringe between vessels, followed by injection of small volume of saline to separate structures

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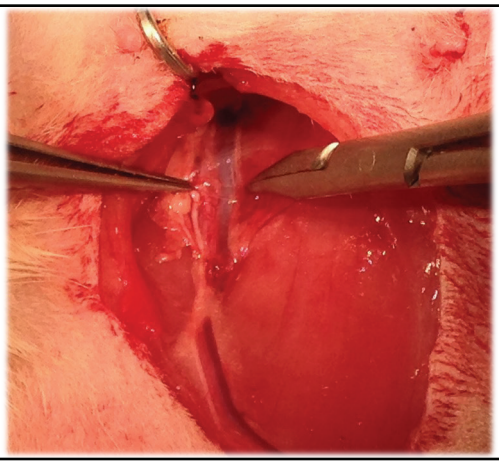

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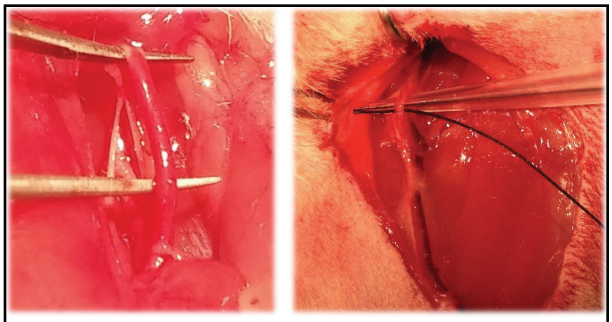

Femoral Vein or Artery catheterization is performed following the same techniques described earlier in this presentation in the common carotid and external jugular sections

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201

- Subcutaneous tissue is approximated with absorbable suture in a continuous pattern
- Skin is closed with
  - Monofilament, non-absorbable suture in an interrupted fashion, or
  - Surgical Clips

Surgical skin glue (cyanoacrylate) may be applied to reinforce (and provide a microbial barrier) the incision

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Femoral Artery Catheterization in the Rat Video

8:04

203

Femoral Artery Catheterization in the Rat Video

204

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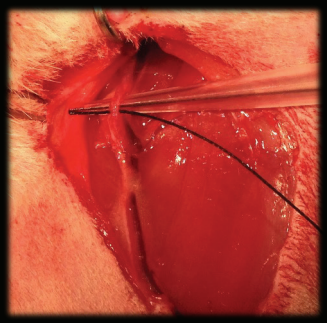
Femoral Vein Catheterization in the Rat Video

4:01

205

Femoral Vein Catheterization in the Rat Video



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Training Resources:
https://research.utsa.edu/compliance/larc/training.html

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