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Partial medial meniscectomy model of osteoarthrtis in mice

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We use this protocol and it's working

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Abstract

This protocol describes how to perform a unilateral partial medial meniscectomy in mice. Partial medial meniscectomy causes destabilisation of the knee joint and leads to the development of osteoarthritic features I.e cartilage degradation and osteophyte formation, within the joint.

Materials

Equipment and consumables:
Heating blanket
Chlorhexidine
Isofluorane anaesthetic rig + oxygen concentrator
Dissection microscope
Electric shaver
70% Ethanol swab
1ml Syringes
26 G needle
Sterile gloves
Viscotears
Surgical drape, sterile
Scale, to weigh mouse
Sterile cotton swabs or surgical spears
Recovery chamber
Vicryl 6-0 round-bodied needle suture kit
Ethilon 5-0 reverse-cutting needle suture kit
Sterile water

Recommended tool set:
Surgical needle holders, sterile
Dumont fine-tipped tweezers, #5 (e.g., World Precision Instruments, 500342)
Surgical forceps (e.g., World Precision Instruments, 15915)
Surgical scissors (e.g., World Precision Instruments, 503222)
15°, 3-mm microsurgical knife (stab knife; e.g., World Precision Instruments, 501731)
#15 blade disposable scalpel (e.g., Swann Morton, 0505)

Drugs & Chemicals:

	Name	Concentration
	Vetergesic	0.3 mg/ml
	Torbugesic	10 mg/ml
	Isoflurane	4% induction, ~2% maintenance
	Saline	0.9%, sterile

Ensure all surgical items are autoclaved prior to commencing surgery.

Before start

Ensure all surgical items are autoclaved prior to commencing surgery.

Prepare anaesthesia equipment and analgesics

1 Dilute 1 ml of 0.3 mg/ml Vetergesic with 11 ml sterile water for injection to give a final concentration of 0.025 mg/ml.

2 Dilute 0.1 ml of 10 mg/ml Torbugesic with 3.9 ml sterile water to give a final concentration of 0.25 mg/ml.

3 Turn on oxygen cylinder or oxygen concentrator and set the flow of oxygen is 1 litre/min.

4 Turn on heating blanket

Prepare surgical setup and mouse for surgery

5 Clean surgical area including microscope. Lay out sterile drape and place surgical kit, microsurgical knife, disposable scalpel, Vicryl suture kit and Ethilon suture kit onto drape.

6 Weigh mouse.

7 Place mouse into isoflurane induction chamber and set vaporiser to 4% until deep level of anaesthesia is achieved.

8 Remove mouse from box and, in a separate area, use a shaver to remove the fur from around the knee joint you intend to operate on.

9 Shave the anterior right knee and, using tape, collect loose hair and discard.

10 Administer 0.1 mg/kg Vetergestic and 1mg/kg Torbugesic via subcutaneous (s.c.) injection.

Note that surgery on the right knee joint is easier for right-handed individuals.

11 Place the anaesthetised mouse on the surgical area and place the nose of the mouse into an anaesthesia nose cone. Set the vaporiser to the appropriate level at which anaesthesia is maintained (by checking front paw pedal reflexes), but no more (usually around 2%).

12 Swab shaved area with iodine/chlorhexidine solution.

13 Wipe remaining solution off with a 70% ethanol swab.

14 Administer Viscotears to prevent eyes from drying out.

15 Cover mouse with small sterile drape with right leg through the hole.

16 Remove gloves and put on sterile surgical gloves following correct aseptic technique.

Partial medial meniscectomy surgery

17 Make an initial incision, 8 to 12 mm long, medially to the knee with the #15 blade, exposing the white parapatellar ligament.

18 Make the secondary incision medially to the white parapatellar ligament.

19 Staunch any bleeding with a sterile cotton swab or surgical spear.

20 Open incision with fine-tipped tweezers.

21 Identify the medial meniscotibial ligament (MMTL) and use fine-tipped tweezers to blunt dissect the fat pads as necessary.

22 Insert the microsurgical knife into the incision below where the MMTL was identified, with the blade facing up.

23 Apply gentle but steady pressure upwards, until you feel the ligament snap.

24 Identify the cut end of the MMTL.

25 Sham operated controls should include everything up to this point, but the MMTL should be left intact.

26 Use fine tipped tweezers to grab the cut end of the meniscus and use your other hand to cut the other end of the meniscus with the microsurgical blade. About a 1-2mm piece of the MMTL should be removed.

Closure and recovery

27 Close the joint capsule using a surgeon's knot with the 6-0 Vicryl sutures.

28 Close the skin using surgeon's knot with the 5-0 Ethilon sutures. Around 3 sutures should be sufficient depending upon the size of the incision.

29 Place mouse in the recovery chamber and return to home cage once it is weight bearing.

Protocol references

1 Blease A, Das Neves Borges P, Curtinha M, Javaheri B, von Loga IS, Parisi I, Zarebska J, Pitsillides A, Vincent TL, Potter PK. Studying Osteoarthritis Pathogenesis in Mice. Curr Protoc Mouse Biol. 2018 Dec;8(4):e50. doi: 10.1002/cpmo.50. Epub 2018 Sep 21. PMID: 30240153.

Modeling and Assessing Osteoarthritis in Mice by Destabilization of the Medial Meniscus (DMM).
Miotla-Zarebska J, Parisi I, Batchelor V, Vincent TL, Potter PK. Methods Mol Biol. 2023;2598:357-373. doi: 10.1007/978-1-0716-2839-3_26.