**ANESTHETIC DRUG****COMBINATIONS** (IN LAB ANIMALS)

In general, by mixing anesthetic and analgesic drugs, the dose required for each individual drug is reduced, sometimes quite dramatically. Start at the low end of the dose range listed; you can always give more if needed!  Drugs not listed below can be mixed using the same concepts, mix a sedative or hypnotic with an analgesic. Do not mix drugs in the syringe until you have determined that they are compatible when mixed. If in doubt administer separately.

**Determining expiration dates for mixed/diluted anesthetic or pain relieving drugs:** In the absence of empirical evidence, expiration dates of diluted or mixed drugs will be determined as follows:

1. Manufacturer�s dating of the drugs to be mixed together will determine the expiration date if shorter than the timelines given below.
2. Mixed anesthetic drugs (ketamine, xylaxine, acepromazine, butorphanol, telazol): Expiration date is 30 days after mixing, based on Minnesota Board of Pharmacy recommendations.
3. Diluted drugs (buprenorphine) - Expiration date is 30 days from dilution date.
4. Avertin - All solutions should be discarded 4 months after mixing, including stock solutions. pH should be tested prior to every use. Solution should only be used if pH is greater than 5. See <http://www.ahc.umn.edu/rar/avertin.html>
5. Any substance which shows signs of precipitation, change of color, change in transparency or other signs of transformation should be immediately discarded.
6. All diluted/ mixed substances must be combined into sterile containers (unless the combination is for a single acute procedure and the mixture will not be stored).

**Ketamine/Diazepam**: Mix drugs 1:1 by volume and administer 0.1 ml/kg IV for restraint, anesthetic induction or for non-painful procedures. This gives excellent muscle relaxation, has minimal respiratory or cardiovascular depression and the animals wake up smoothly and quickly (within 10-15 min). Visually, these drugs do not appear to mix completely. When combined and administered as described, the dose is 5 mg/kg ketamine and 0.25 mg/kg diazepam.

**Ketamine/Acepromazine**: Mix 10 mg acepromazine (1 ml) with 1 g (10 ml) ketamine and give 0.1-0.3 ml/kg mixture IM or IV (up to 0.6 ml/kg in rodents and rabbits). Good for restraint, but not for painful procedures. When combined and administered as described, the dose is 0.09-0.27 mg/kg acepromazine and 9-27 mg/kg ketamine.

**Acepromazine/Butorphanol**: Mix drugs 1:1 by volume (using 10 mg/ml butorphanol) and administer at 0.01-0.02 ml/kg IV or IM. Creates a hypnotic state that is good for restraint and minor procedures that cause some pain. When combined and administered as described, the dose is 0.05-0.1 mg/kg butorphanol and 0.05-0.1 mg/kg acepromazine.

**Ketamine/Acepromazine/Butorphanol**: Mix 10 mg acepromazine (1 ml), 10 mg butorphanol (1 ml) with 1 g (10 ml) ketamine and give 0.1-0.3 ml/kg of mixture IM or IV (up to 0.6-0.8 ml/kg in rodents and rabbits). Good for restraint and moderately painful procedures. More cardiac and respiratory depression will be seen with this mixture than with ketamine alone. When combined and administered as described, the dose is 8-25 mg/kg ketamine, 0.08-0.25 mg/kg acepromazine, and 0.08-0.25 mg/kg butorphanol. For rodents & rabbits, the dose is 50-67 mg/kg ketamine, 0.5-0.7 mg/kg acepromazine, and 0.5-0.7 mg/kg butorphanol.

**Ketamine/Xylazine**: Good for restraint and painful procedures. Administer IM, IP, or IV. More cardiac and respiratory depression will be seen with this mixture than with ketamine alone. Use 100 mg/ml ketamine and 100 mg/ml xylazine to create any of the mixtures listed below.  
  
**CAUTION:** DO NOT USE this cocktail of ketamine-xylazine for cattle, sheep, goats, or other ruminants. Giving ketamine and xylazine simultaneously is not recommended for horses.

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| **Species** | **Recipe by volume        (ket:xyl)** | **Vol to give   (ml/kg)** | **Dose (per kg body weight)** | **Sedation insufficient? May redose with ketamine alone...** |
| Mouse | mix 10:1 | 1.1 | 100 mg Ket + 10 mg Xyl | At 1/3 to 1/2 original volume |
| Rat | mix 15:2 | 0.85 | 75 mg Ket + 10 mg Xyl | At 1/3 original volume |
| Rabbit | mix 20:3 | 0.40 | 34 mg Ket + 5.2 mg Xyl | At 1/3 to 1/2 original volume |

**Ketamine/Midazolam/Butorphanol**: Mix 0.4 ml each ketamine and midazolam with 0.01 ml of 10 mg/ml butorphanol and administer 0.8 ml/kg. This provides good muscle relaxation and surgical anesthesia in rodents. When combined and administered as described, the dose is 40 mg/kg ketamine, 2 mg/kg midazolam, and 0.1 mg/kg butorphanol.

**Telazol/Xylazine**: For pigs: reconstitute powdered Telazol (tiletamine & zolazepam) with 5 ml of xylazine instead of saline. For pigs < 50 kg, use 20 mg/ml xylazine to make the cocktail. For pigs > 50 kg, use 100 mg/ml xylazine. Administer at 0.05-0.1 ml/kg IV or IM. When combined and administered as described, the dose is 2.5-5 mg/kg tiletamine, 2.5-5 mg/kg zolazepam, and either 1-2 mg/kg xylazine (if 20 mg/ml xylazine was used) or 5-10 mg/kg xylazine (100 mg/ml xylazine). For rats, use 20 mg/ml xylazine and administer up to 0.4 ml/kg IM. Here, the dose can be as high as 8 mg/kg xylazine, 20 mg/kg tiletamine, and 20 mg/kg zolazepam.  
More cardiac and respiratory depression will be seen with this mixture than with Telazol alone.  
Reversal with yohimbine 0.1-0.15 mg/kg (IM or IV) or atipamezole at 0.25 (IM) or 0.2 (IV) mg/kg is recommended to shorten recovery times.  
CAUTION: DO NOT USE this cocktail of Telazol-xylazine for mice, rabbits, or ruminants such as cattle, sheep, or goats. Giving Telazol and xylazine simultaneously is not recommended for horses (contact an RAR veterinarian for more information).