Etiologies and Treatment of Genital Injuries in Juvenile Squirrels in Rehabilitation

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Abstract: Squirrel rehabilitators often care for juvenile squirrels that arrive with genital injuries or develop these injuries during rehabilitation. Genital injuries may be minor, or severe and possibly life–threatening. Falls or similar trauma may cause injuries to the urogenital system; however, the more common genital injuries in juvenile squirrels are self–inflicted or a result of damage by a cagemate. This article describes such injuries, as well as their causes and possible treatments. Photographs and a glossary add clarity to the paper.

Keywords: Squirrel genital nursing, urinary tract infection (UTI), genital injuries, teething, emaciation, dehydration, squirrel rehabilitation, squirrel health problems, rodent UTI

Introduction

Squirrel rehabilitators often care for juvenile squirrels that arrive with genital injuries or develop these injuries during rehabilitation. Genital injuries may be minor, or severe and possibly life–threatening. Falls or similar trauma may cause a few of the injuries to the urogenital system; however, the more common genital injuries of juvenile squirrels are self–inflicted or a result of damage by a cagemate. This article describes such injuries, as well as their causes and possible treatments.

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Description of Injuries

Squirrels that fall from trees or experience other trauma may incur a variety of severe internal injuries, including ruptured or punctured bladder and torn or severed ureter or urethra. Squirrels with these severe internal injuries may die quickly. In a few cases, a squirrel with a severed or torn ureter or urethra may die a few days later from septicemia resulting from urine spreading throughout the abdomen or expelled from the body through a new opening as shown in Figures 1 and 2.

More common signs of genital injuries, however, include swelling, distention, inflammation, and bruising of the penis, prepuce, scrotum, or vulva caused by a squirrel suckling on itself or another. In more severe cases, there may be raw and bloody abrasions, scabs obstructing the urethral or preputial openings, hemorrhage, or indications of infection. For reference, Figure 3 shows normal condition and stimulation. Figures 4, 5, and 6 show the severity of continued genital nursing (early, moderate, and more severe stages, respectively).

While the more serious genital injuries generally are found on male juvenile squirrels, injuries also may occur on the females. Most of the genital injuries to juvenile squirrels have occurred between the time when the eyes open to the time they are fully weaned and eating solids.

Considering The Causes. Rehabilitators often speculate about the possible causes of genital nursing. Some have wondered if it could stem from a need for oral stimulation, since the squirrel is being fed with a syringe rather than nursing on its lactating mother. Others have wondered if the cause might be related to separation from the mother or siblings. However, juvenile squirrels and other animals raised by their mothers and living in the original litter, genital nurse, including kittens and puppies.

Figure 1. Juvenile male squirrel with torn ureter open to surface.

Some rehabilitators think genital nursing might be an obsessive habit, like a human toddler sucking his/her thumb. While a few people have wondered if this behavior is related to sexual stimulation, this idea has been discounted since these are very young animals. Others hypothesize that genital nursing could be a response to stress, boredom, or captivity. Although all factors must be considered in an overall assessment, closer examination suggests there are a variety of underlying physical causes for the problem.

Initial Dehydration and Starvation. Most juvenile squirrels are admitted to rehabilitation after the death of or separation from their mothers. Denied nutrition and often starving, juvenile squirrels may begin suckling on any soft available body part that resembles the mother's nipple. If the squirrel obtains moisture from it, they are likely to continue. A male juvenile squirrel admitted to rehabilitation with a swollen, elongated, and injured penis may have had this done by a sibling or it may be self–inflicted (Figure 7). Several rehabilitators have described situations when a single surviving squirrel from a litter was the one that 're–circulated fluids' instead of dying of dehydration.

Juvenile squirrels presented to rehabilitation in a severely dehydrated and emaciated state generally stopped sucking on genitalia after they were fully hydrated, given an appropriate and nutritious diet, and fed the correct amount at the recommended frequency.

Hunger and Thirst During Rehabilitation. If a juvenile squirrel is given a milk replacement formula that does not meet his/her nutritional requirements, the animal may attach to the closest 'faucet' in response to hunger and thirst. Nutritional requirements include both the ingredients and the formula dilution.

Orphaned mammals must have an effective and nutritious milk replacement formula that meets the specific dietary needs. Check with other experienced

Figure 2. Juvenile male squirrel with torn ureter open to surface (close–up). A veterinarian euthanized the squirrel after treatments were unsuccessful.

Figure 3. Normal size and shape genitals of a 6–1/6 week old male fox squirrel (Sciurus niger). Stimulation of genitals resulted in normal urination.

Figure 4. Male juvenile squirrel presented for rehabilitation with mild dehydration and minor swelling and elongation due to suckling.

squirrel rehabilitators about high quality and reliable milk replacement formulas for juvenile squirrels that result in steady growth and few diet–caused health problems. That said, the nutritional needs of young squirrels change as they grow. Juvenile squirrels with the eyes open require more fat in the diet than infant squirrels that are on the formulas used prior to the opening their eyes. (Casey and Casey 2003). Adding heavy whipping cream or Multi–Milk™ (PetAg®, Inc., Hampshire, IL) to the basic formula better meets the squirrels' dietary needs once the eyes open and thereafter.

A few days after juvenile squirrels open their eyes, they may be fed formula four times a day by extending the time between feedings to over four hours. Adding a tiny amount of rodent chow dust to the formula several minutes before the feeding gives more substance to the formula and seems to sustain the squirrels longer between meals. Continuing to add a high quality rodent chow dust to the formula of older juvenile squirrels familiarizes them with the taste of rodent chow, resulting in a greater willingness to eat this nutritionally balanced solid food. Eating rodent blocks helps the overall growth and development of juvenile squirrels, as well as keeping the ever–growing incisors trimmed. There also have been cases when the milk replacement ingredients were appropriate, but the formula was too diluted and provided inadequate nutrition. When the formula was corrected to the appropriate dilution, the squirrels immediately stopped the genital nursing.

Squirrels that are not fed enough formula per feeding also may resort to genital suckling due to hunger. Juvenile squirrels are given approximately five percent of the body weight at each feeding until they are on two formula feedings per day; then, they are fed approximately six to seven percent of the body weight (Casey and Casey 2003). By the time a juvenile squirrel is being fed formula only twice daily, it should aggressively eat rodent chow blocks and be close to weaning.

Juvenile squirrels that are not fed the appropriate number of times in a day may suckle on genitalia due to hunger and thirst. Genital nursing also can result if

Figure 5. Male juvenile squirrel presented for rehabilitation with mild dehydration and swelling and elongation due to suckling.

Figure 6. Male juvenile squirrel with phimosis from self–injury due to UTI and, probably, teething.

feedings are spaced too far apart. These and the above factors must be assessed and corrected.

When the right feeding frequency, interval, and amount of formula per feeding is used, along with high quality rodent chow, squirrels no longer are hungry and the genital nursing behaviors stop in the majority of cases. When hunger and thirst have been eliminated as possibilities and the suckling continues, the behavior is likely to have a different cause.

Teething. While a squirrel's four incisors (front teeth) are most noticeable, squirrels actually have a total of 20 to 22 teeth, depending on species (Steele and Koproski 2001). The lower incisors erupt first and prior to the squirrel opening its eyes; this is followed by the eruption of the upper incisors about the time the squirrel's eyes first open. The remaining teeth are premolars and molars that all begin erupting about the same time. While development of a squirrel's premolar and molar teeth are noticed less, and possibly even forgotten by the caregiver, these sixteen to eighteen teeth erupt over the next four to eight weeks. It is not uncommon for at least one, if not several, of these teeth to be painful as they break through the gums. Consider children when they are teething: they want to chew on something, or at least have something in their mouth. While the rehabilitator still has to rule out other causes such as hunger, juvenile squirrels that start nursing or chewing on a cagemate may be experiencing painful teething. Unfortunately, the squirrel that aggressively nurses or chews on a cagemate can cause serious injury.

In most cases, teething difficulties stop when the teeth are fully erupted and the squirrel is comfortably and eagerly eating solids. Action may need to be taken in the interim to reduce risk of injury to other squirrels. If teething difficulties are suspected, the squirrel that is nursing on others should be transferred to a separate cage. If painful teething is the cause of the nursing, the squirrel either may stop the inappropriate chewing or sucking or start chewing on soft twigs or rodent chow.

Figure 7. Male juvenile squirrel presented for rehabilitation with severe emaciation and dehydration and with swelling and elongation due to suckling.

Figure 8. Male juvenile squirrel with wet genitalia, elongation, bruising, and scab obstructing penis from self–suckling due to UTI and, probably, teething.

Homeopathic veterinarians may prescribe one or two doses (total) of homeopathic *Chamomilla* 30c, *Calcarea Carbonica* 30c, *Calcarea phosphoricum* 30c, or *Nux vomica* 30c depending on the description of teething difficulties. Such carefully selected homeopathic remedies have helped children overcome painful teething during the last two centuries and have been helpful with animal patients as well.

Urinary Tract Infection. Many rehabilitators may not recognize the symptoms but urinary tract infections (UTI) are not uncommon in juvenile squirrels. Most young orphaned squirrels are dehydrated when admitted to rehabilitation. The inadequate fluid intake has resulted in little or no urination, which can create a medium for the build–up of bacteria in the bladder and urethra. Retention of urine due to delayed or incomplete voiding is a common cause of UTI.

[***Author's Note:*** Adult squirrels that have difficulty urinating due to pelvic or abdominal trauma may need similar attention to prevent and/or treat a UTI.]

This bacterial overgrowth may be flushed through the urinary tract as the squirrel is hydrated and begins urinating again; usually the bacteria is flushed out more easily and completely through the female squirrel's wider urethra. The juvenile male squirrel's longer and narrower urethra can result in retention of bacteria and increase the likelihood of a persistent low–grade urinary tract infection (Casey and Goldthwait 2003).

One of the best defenses against bacterial growth in the bladder is complete voiding. The rehabilitator needs to stimulate the squirrel to empty its bladder after each feeding. The amount of urine expected, in a well–hydrated animal, after a formula feeding should be about 60 to 70 percent of the amount of formula fed per feeding. An easy way to determine the amount of urine to expect is to pull the representative 60 percent into a syringe, expel it into a container, and soak

Figure 9. Male juvenile squirrel with paraphimosis which recovered after treatment with homeopathic remedy, Epsom salt baths, and topical application of aloe vera gel. (Photo by T. Muzik, CA.)

the liquid up with a tissue (A squirrel fed 12 cc of formula at a feeding should produce approximately 8 cc of urine.).

As mentioned earlier, UTI's seem more common in juvenile male squirrels, possibly due to the build up of bacteria in the narrow urethra as a result of dehydration, but also should be considered with female squirrels. Juvenile squirrels with a UTI will suckle themselves due to painful genitalia and urination, and normally not suckle and injure a cagemate.

It is not uncommon for a juvenile squirrel that has been the target of such genital suckling or external injury to develop a UTI. Some rehabilitators have even speculated that a juvenile squirrel that is the target of the genital nursing may already have a UTI or compromised health, thus either attracting or being unable to ward off the aggression.

The signs of UTI's in squirrels include very slow urination when the caregiver stimulates the youngster to urinate (i.e., drop by drop). Other indications of a UTI include wet genitalia or abdomen (Figure 8) due to involuntary urination (leaking), or damp bedding where the squirrel was sleeping (and the squirrel did not voluntarily urinate on the bedding). The squirrel's urine may be cloudy or discolored, or have a strong odor.

Humans with UTIs generally have extreme, burning pain upon urination. Squirrels may experience similar pain and discomfort. Excessive squirming, squatting, vocalization, or other unusual behavior during urination may be evidence of pain. Many juvenile male squirrels that have been self–nursing subsequently have had confirmed UTIs. If a squirrel that is self–nursing shows the signs mentioned above, the rehabilitator should consult with a veterinarian to have a UTI confirmed and treated.

A squirrel with a UTI should be stimulated to urinate several times a day and the caregiver should ensure it has voided completely each time, even if the squirrel is old enough to be urinating on its own. In rare cases, the veterinarian or rehabilitator trained in this technique may need to express a squirrel's bladder. If the bladder is extremely full, the bladder walls are likely to be stretched thin and be very fragile. Anyone that manually expresses a squirrel's full bladder must use considerable caution to avoid rupturing the bladder. This only should be attempted by those trained in proper technique.

Veterinarians have prescribed antibiotics for squirrels with UTIs, such as sulfamethoxazole, with or without added trimethoprim, for 14 to 21 days. Rehabilitators working with holistic veterinarians have reported successful resolution by using minute doses of herbal cranberry powder for only two to three days in the early stages of a UTI and/or using concurrent with other treatments. In some cases, herbal cranberry powder may be given for seven days. Cranberry powder is dosed at 20 mg/kg divided into daily doses. The powder is diluted with water and administered orally with a 1–ml syringe. Use only low sugar products with highest juice concentrate possible (Winn and Fougere 2007).

Homeopathic veterinarians, on the other hand, have recommended two doses of homeopathic *Cantharis 30c* on a single day. If the UTI has been ongoing for more than several days before homeopathic *Cantharis* is given, they may recommend following the *Cantharis* with one or two doses of homeopathic *Sulphur 30c* on the next day.

Animals with compromised health should have access to supplemental heat and should have activity limited (a smaller cage) until recovered.

Treating the Injuries

A juvenile squirrel's aggressive suckling may cause harm to another or him/herself. If the injury is slight bruising and/or minor swelling, those should diminish within a day or two after the genital nursing has stopped.

A squirrel with significant swelling, elongation, and inflammation of the penis or prepuce should be placed in a separate cage because the injury requires careful monitoring and should have the swelling and inflammation reduced quickly, within a day or two. It is essential to keep the tip of the prepuce open so the squirrel can urinate easily. In such cases, after applying warm water compress to the genitalia for several minutes, the rehabilitator can gently remove the scab so the squirrel is able to urinate. This procedure is repeated four to five times daily to keep the tip of the prepuce scab–free.

The caregiver must ensure that any squirrel with genital swelling, injury, or scabbing fully voids the bladder multiple times a day rather than allowing the animal to avoid what might be painful urination. As mentioned earlier, unless the bladder is emptied completely, an accumulation of bacteria and infection could result.

Another helpful method to reduce swelling and inflammation is to soak the squirrel in a warm tub of Epsom salts and water. Just as people take Epsom salts baths for swollen and painful muscles, this treatment has been shown to reduce swelling and inflammation for the squirrel. Rehabilitators using this technique carefully wrap the upper part of the squirrel's body with a washcloth or hand towel and hold the animal in a sitting position, placing the lower body into a bowl of warm Epsom salts and water for a five to ten minute soak, three to four times a day. The squirrel is thoroughly dried and kept warm after each soak. This bath soak is made with two quarts of warm water to one to two tablespoons Epsom salts. Do not allow the liquid to get into the squirrel's mouth, eyes, or ears.

Some rehabilitators have gently applied a small amount of aloe gel or honey to the squirrel's genitalia after a compress or soaking to further reduce swelling and inflammation, especially if raw tissue is exposed.

Cases of paraphimosis (Figure 9) require prompt treatment to reduce the swelling and inflammation of the exposed penis. The exposed penis must be kept moist with the topical application of aloe vera gel, honey, or silver sulfadiazine (Silvadene®, Monarch Pharmaceuticals, Bristol, TN) to facilitate the penis being able to slide back into the prepuce. If swelling and inflammation does not decrease rapidly and allow the penis to returned to or stay in the normal position within 24 hours, it may be necessary for a veterinarian to make a tiny incision in the prepuce in order to allow penis movement to the normal position. Placement of a purse–string suture to hold the incision together and the prepuce closed into a smaller opening to prevent the penis from slipping out again also may be necessary. If the tip of the penis dries and becomes necrotic, euthanasia is necessary.

Antibiotics and pain medications also may be prescribed if needed. Homeopathic veterinarians may prescribe three or four doses (total) of a carefully selected homeopathic remedy that corresponds to paraphimosis, such as *Mercurius* 30c, *Nitric acidum* 30c, or *Lachesis* 30c. Homeopathic remedies are available from natural foods stores, homeopathic distributors, and some pharmacies.

Be aware that many topical medications may not be appropriate or even safe for use on raw, abraded, or swollen tissue. Do *not* apply topical products such as bitter apple or orange as they are not meant for open sores or raw tissue and can cause serious pain and permanent damage. Similarly, herbal calendula should *not* be used over the tip of the penis or prepuce due to its ability to rapidly heal and close wounds. Calendula can heal any raw tissue and may potentially obstruct a natural opening. Preparations that could damage the skin or cause harm if ingested also should not be used. Most topical antibiotic preparations contain ingredients that are harmful or fatal to squirrels if ingested orally.

It is essential to consult with a veterinarian if the squirrel's genitalia are severely injured since such conditions can quickly become life–threatening.

Stress, Boredom, Seeking Comfort, Aggression. While it is possible that a few squirrels might suckle cagemates or themselves due to boredom or high stress in rehabilitation, this is probably rare as a single cause. It also is possible that some juvenile squirrels may exhibit aggressive behavior toward and target a sibling or cagemate that is weaker or already has a health problem, such as a UTI. As mentioned before, while the target and aggressor should be separated, other treatments may be necessary.

It is more likely that the juvenile squirrel is engaging in such suckling due to hunger, thirst, teething, or UTI conditions rather than from stress. Reducing possible stressors and adding branches and other objects with which the squirrel can play would quickly test this. The odds are high that the actual cause of genital nursing behavior is one or more of the physical factors mentioned above.

Glossary of Terms

Dentition—a general term for all the teeth and their orientation in the mouth
Express bladder—the act of holding the bladder through the abdominal wall to gently squeeze it and empty it of all the urine
Genital—pertaining to the male and female reproductive organs
Genitalia—a general term for the male and female reproductive organs
Incisors—the teeth at the front of the mouth that incise or cut food
Molars—teeth in the side and to rear of the mouth used for grinding food
Prepuce—the sheath in male animals that covers the entire penis to protect it and prevent damage or drying out
Preputial—of or pertaining to the prepuce
Paraphimosis—condition in which the penis is unable to retract back into the prepuce
Phimosis—condition in which the penis is unable to protrude out of the prepuce
Premolars—teeth in front of the molars in the cheeks used for grinding food
Purse–string suture—a continuous stitch suture placed around an opening making it smaller or narrower to prevent contents from falling or leaking out
Septicemia—a bacterial blood infection, not confined to a specific organ or tissue, but spread throughout the body
Ureters—the tubes that carry urine from the kidneys to the bladder
Urethra—the tube that carries urine from the bladder to the outside
Urogenital—a word that encompasses the organs of the urinary system and reproductive tract
UTI—acronym for urinary tract infection
Void—as a verb, the act of emptying something of its contents
Vulva—the external flap in a female that protects the vagina; the equivalent of a male's prepuce

Conclusion

While some genital injuries and urinary tract infections may be minor, others may be serious and life–threatening. Rehabilitators should monitor a squirrel's urination in order to notice signs of problems, such as slow, painful, or involuntary urination, difficulty voiding, or cloudy urine. Rehabilitators also should be alert to signs of swelling or inflammation, scabs, or urinary obstruction. The earlier urogenital problems are noticed, the faster and easier they may be to correct.

It is essential for rehabilitators to know what might cause the problems, such as injury, poor nutrition, urinary tract infections, and teething. Familiarity with possible causes allows the rehabilitator to address the cause, to stop or prevent future problems, as well as determine treatment options. Some urogenital problems may be resolved by modifying husbandry, such as diet, feeding amount, and feeding frequency, or the squirrel outgrowing teething difficulties. While some of the urogenital conditions may be treated with first aid or easy treatments, others may require veterinary assistance. Regardless, it is important for squirrel rehabilitators to be familiar with these types of conditions, potential causes, problems that may be prevented and corrected, and possible treatments.

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