IMPORTANCE OF SUTURE MATERIAL SELECTION IN EXOTIC PET MAMMALS

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Elisabetta Mancinelli provides a reminder of why suture selection is such an important decision, discussing studies that highlight pros and cons of each material

THE popularity of exotic pets has increased exponentially over the past few years. This phenomenon has led to the need for more specialised veterinary care and the necessity of providing a level of care comparable to that available for dogs and cats.

The quality of exotic pet medicine has therefore increased, with the availability of more scientifically accurate information specific to each species. Procedures and techniques used in exotic pet practice have often been derived and adapted from that of more common domestic species, but, lately, studies have been performed to evaluate the use of methods or products specifically developed for exotic species.

The choice of appropriate suture material is extremely important in surgery, but often overlooked. Sutures are generally used either internally or externally, to appose incised or injured tissue, allowing the healing process (Bellenger, 1982). The ideal suture material would have characteristics of: high tensile strength, good knot security, not cause inflammation or other tissue reaction, and resistance to infections (McFadden, 2011).

Unfortunately, a single suture material may not be appropriate for all surgical situations. Knowledge of different suture characteristics is, therefore, essential to make the correct choice, as this will influence healing of tissues, functional and cosmetic outcome.

Sutures are generally classified into four main categories: absorbable or non-absorbable; monofilament or multifilament (depending on whether they are composed of a single strand or braided). Absorbable suture materials lose their strength within 60 days of implantation and can be biological or made of synthetic polymers (Tan et al, 2003). Common absorbable sutures include: chromic gut, polydioxanone, poliglecaprone 25, polyglactin 910, glycomer 631, polyglyconate, lactomer and polyglycolic acid. Nonabsorbable suture materials, either synthetic or biologic in origin, do not degrade significantly after use. They are, therefore, generally intended for skin closure, where suture removal is later performed, or when extensive wound support is required.

The most commonly used ones in veterinary medicine are silk, nylon and polypropylene. Table 1 provides a list of the suture materials most commonly used in practice and their main characteristics.

Rabbits and rodents have long been used as animal models in research investigating tissue reactions. In 1980, a study was carried out to compare histologic reactions to polyglactin 910, polyethylene and nylon microsutures in rabbits (Gomel et al, 1980). Results showed polyglactin 910 caused less residual inflammation by day 80 from implantation compared to nylon, which remained in the tissues, causing a persistent inflammatory reaction.

Tensile strength

However, other studies (Scheidel et al, 1986; Hanke et al, 1994) showed the histologic reaction on rabbits' oviducts caused by polyglactin 910 did not differ from that caused by polypropylene, and that gut and chromic gut were associated with the greatest inflammatory reactions on rabbit bladder tissue, followed by polyglactin 910 and polypropylene. Shin et al (1999), in a comparative study of subcutaneous suture materials in rabbits, found poliglecaprone 25 had the strongest tensile strength and catgut had the weakest. Polyglactin 910 was a little stronger than polydiozanone.

The tensile strength of poliglecaprone 25 rapidly decreased from the third day after implantation and became the weakest one after the seventh day of implantation. The most severe inflammatory reaction was seen with catgut – its use is, therefore, not recommended in species prone to develop adhesions, such as rabbits.

Poliglecaprone 25, polyglactin 910 and polydioxanone were similar in inflammatory reaction, but more severe giant cell and histiocytic reactions were seen with polyglactin 910. The least absorption was seen in polydioxanone and this was well correlated with loss of tensile strength. Results, therefore, suggested of all the suture materials tested, poliglecaprone 25 was one of the best absorbable suture materials.

Many rabbits are inclined to excessively lick or chew at their skin sutures, so the use of absorbable sutures in an intradermal/ subcuticular pattern is often preferred.

Metal staples or tissue glue/ adhesive are often used for skin closure in rabbits. Their use is only external and generally well tolerated. Metal staples will require removal. Post surgical adhesion formation is a well recognised complication in rabbits (Jenkins, 2012). The cause is not entirely understood, but several risk factors have been identified, such as foreign material (for example, talc from gloves or lint from gauze swabs), the use of nonpolymer suture material or suture material that may result in an intense inflammatory reaction, rough tissue handling during coeliotomy, presence of blood in the abdominal cavity after surgery or application of povidone iodine into the abdominal cavity.

Reaction

The selection of an absorbable suture material with low reaction potential is, therefore, extremely important, along with an appropriate surgical and tissue handling technique. The author has seen several cases of post-surgical adhesions and complications secondary to the use of non-absorbable suture material **(**Figures 1 and 2**).**

Polyglyconate, polyglactin 910, chromic gut and polydiaxanone were compared in rats (Sanz et al, 1988) and results confirmed polyglyconate and polydiaxanone caused less inflammatory reaction in rats' body wall, compared to polyglactin 910 and chromic gut. When poliglecaprone 25 use in rats' subcutaneous tissues was compared to polyglactin 910 and polytetrafluorethylene, poliglecaprone 25 caused significantly less inflammatory reaction than polyglactin 910 and polytetrafluorethylene at 48 hours following implantation (Nary-Fiho et al, 2002).

In another study (Yaltirik et al, 2003) it was shown poliglecaprone 25 and glycomer 631 were less reactive than polyglactin 910 in rat skin, but all three suture materials were considered acceptable, especially for subcuticular use, because of their low tissue reaction values (Molea et al, 2000). Polydioxanone had the lowest reaction score and polypropylene the highest rate of granuloma formation when the use of polydioxanone, polyglycolic acid, polyglactin 910, silk and polypropylene was compared in rat uterine tissue (Quesada et al, 1995). Polydioxanone was also superior to chromic gut and polyglactin 910, which had greater inflammation and stone formation potential on rat bladder tissue (Kosan et al, 2009).

Characteristics of polyglycolic acid, silk, polyglactin 910, chromic gut, polypropylene and polydioxanone were compared in a study where these materials were used in wounds inoculated with the same bacteria found in the colon. Results showed monofilament absorbable sutures, except for polydioxanone, lose strength very quickly, but the multifilament materials resulted in a higher risk of infections due to harbouring of bacteria (Durdey and Bucknall, 1984).

When a literature search on the use of different suture material in ferrets was performed by the author, a single case report was found describing the development of an intra-abdominal malignant mesenchymoma at the site of previous ovariectomy, performed using non-absorbable suture material. A chronic inflammatory reaction to the suture was suggested to have played a role in

tumour formation (Petterino et al, 2010).

Non-absorbable suture material tends to cause chronic inflammatory responses compared to absorbable materials, which generally create only minor residual inflammation after their absorption. It is, therefore, extremely important to choose, according to specific situations and healing time of different tissues, a material that will retain its tensile strength only long enough for the tissue to heal to reduce the likelihood of granuloma formation or neoplastic transformation of tissues.

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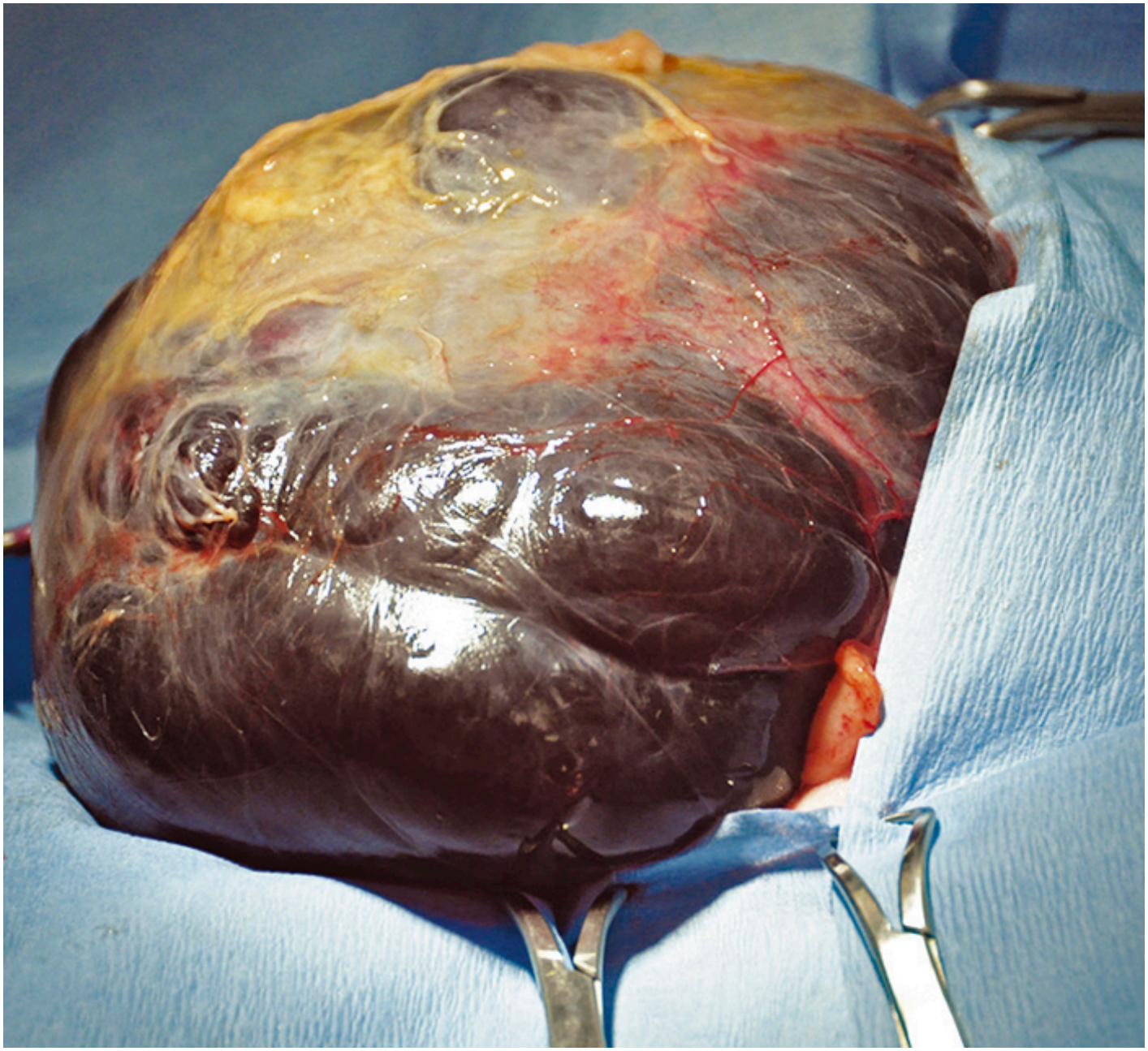

Figure 1. A large abdominal cyst removed from the abdomen of a six-year-old, neutered male rabbit. Histology confirmed the cystic capsule submitted was consistent with a chronic haematoma with fibroplasia and granulation tissue formation. Intralesional suture material was seen in the lesion. The cyst was a seroma with haemorrhage and subsequent haematoma formation, probably as a result of previous surgery. The rabbit had undergone surgery six years previously.

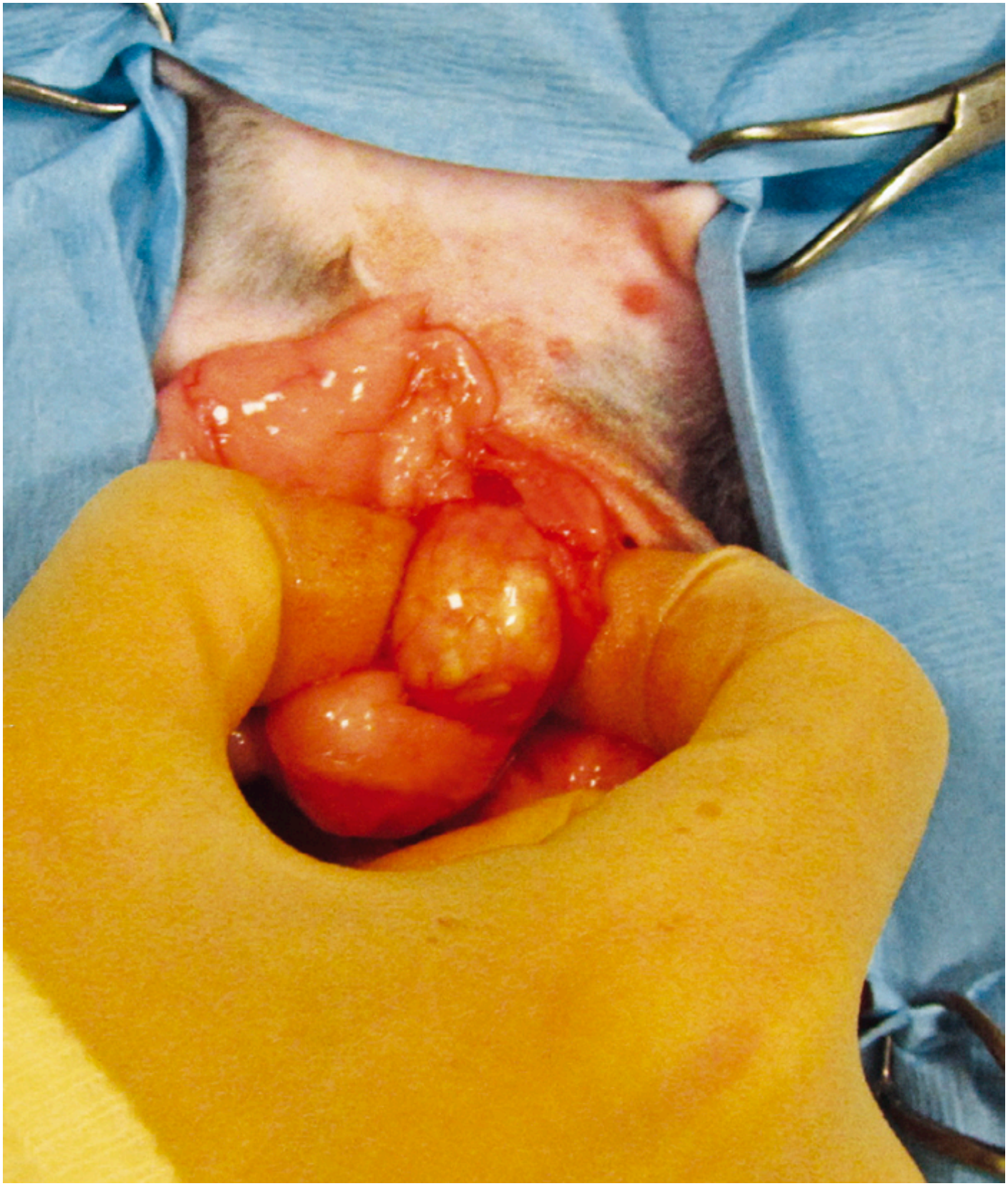

Figure 2. A 1.5cm round soft tissue mass (abscess) connected to the uterine stump, dorsal to the bladder neck and ventral to the colon. The abscess had adhesions with the bladder wall and the colon. The rabbit had been spayed eight months previously and was presented because of dysuria.

Suture type	Absorbable	Non-absorbable	Monofilament	Multifilament	Complete absorption	Tensile strength
Chromic gut	✓		✓		60-90 days	seven-10 days
Polydiox-anone	✓		✓		180 days	70% (at two weeks) 50% (at four weeks)
Poligle-caprone 25	✓		✓		90-100 days	20-30% (at 14 days)
Polyglactin 910	✓			✓	42-60 days	75% (at two weeks) 50% (at three weeks)
Polygly-conate	✓		✓		180 days	80% (at one week) 50% (at four weeks)
Glycomer 631	✓		✓		90-110 days	75% (at two weeks) 40% (at three weeks)
Polyglycolic acid	✓			✓	60 days	20% (at two weeks)
Polyglytone 6211	✓		✓		56 days	80% (at 10 days)
Lactomer	✓			✓	56-70 days	80% (at two weeks)
Silk		✓		✓	more than two years	30% (at two weeks) 50% (at one year)
Nylon		✓	✓	✓		30% (at two years)
Polypro-pylene		✓	✓			Fragmentation (at two to five years)

TABLE 1. The most common suture materials used in practice and their main characteristics