Modification of the triangulation technique for arthroscopy of the canine shoulder joint using a new target device

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Summary
A modified triangulation technique for arthroscopy of the canine shoulder joint to insert a working cannula in the caudal joint pouch is described. This technique is compared with the triangulation technique of Van Ryssen (10). With the modified triangulation the insertion angle for the working cannula into the caudal joint pouch was provided by a target device which was attached to the arthroscopic sleeve. Both methods were carried out on 60 dog cadavers and the differences were recorded in terms of various parameters: success (SUC), time (TT), number of trials (TR), position of the working cannula (PDS), damage to articular cartilage (DAM), and force to remove the working cannula (FOR). The modified triangulation technique permits simpler, faster and less traumatic insertion of the working cannula into the caudal joint pouch.

Keywords
Target device, arthroscopy, canine, shoulder joint, triangulation

Introduction
Diagnostic arthroscopy in the dog was first described in 1977 by Knezevic and Wruhs (3) for the stifle joint. Since then Canine arthroscopy has aroused increasing interest. The development of arthroscopes with a diameter of less than 3.0 mm permitted arthroscopy of smaller joints, such as the canine shoulder joint. Several techniques for diagnostic arthroscopy of the shoulder have already been described (2, 5, 6, 8, 10, 11). The indications for shoulder joint arthroscopy are the diagnosis and treatment of osteochondrosis dissecans (OCD), joint mice, bicipital tendosynovitis, a partial or complete rupture of the bicipital tendon, acute and chronic joint inflammation, articular cartilage degeneration and synovial diseases (1, 2, 5 - 12).

Arthroscopic surgery of the shoulder joint was first performed by Person (5), Goring and Beale (1), and Van Ryssen et al. (11) to treat osteochondrosis dissecans (OCD), joint mice, bicipital tendosynovitis, a partial or complete rupture of the bicipital tendon, acute and chronic joint inflammation, articular cartilage degeneration and synovial diseases (1, 2, 5 - 12).

The triangulation technique was first described by Van Ryssen for the canine shoulder joint (10). According to this technique, a working cannula is introduced into the field of view of the arthroscope such that the ends of the working cannula and the arthroscope form the corners of a triangle (Fig. 1).

After inserting the arthroscope distal to the acromion in the middle of the shoulder joint, the exact position of the working cannula is determined by puncturing the caudal pouch of the shoulder joint with a 5 cm long, 0.6-mm cannula. This cannula is inserted in the direction of the arthroscope tip. The working cannula with trocar is then inserted along the puncture canal into the shoulder joint. This triangulation technique has successfully been used for arthroscopic surgery in the shoulder joint, in particular for the treatment of OCD (11). Fewer postoperative complications have been observed with this technique when compared to other methods which have been described (6). The advantages of this technique over conventional arthrotomy include less soft tissue trauma, faster healing, better cosmetic results and shorter operating time. However, determining the optimal point to puncture and the correct angle of the cannula to the optic, which are necessary in order to successfully puncture the caudal pouch of the shoulder joint, sometimes proved to be very difficult (10). In some cases the trauma to the joint capsule led to leakage of the irrigation fluid from the joint into the surrounding tissue. This peri-articular irrigation fluid caused joint collapse and made insertion of the working cannula difficult because it obscured the field. Also it often proved to be very difficult to locate the instrument tips via arthroscopic view. Furthermore, in some instances joint cartilage was damaged during insertion of the cannula and trocar. These problems did not improve until the experience of the surgeon subscribed to the operations. Only with intensive training was it possible to acquire the skills necessary for the triangulation and depth perception. Approximately one year and 30 cases were required to acquire sufficient skills (10).
Recently a simplified method for arthroscopic surgery was described by Martini (4). This method is, however, not comparable with the triangulation technique (10) that has already been described. The purpose of the work reported here is twofold: firstly, to eliminate the difficulties mentioned above of the described triangulation technique for arthroscopy of the canine shoulder joint (10) by using a target device (Fig. 2) and secondly, to compare the two techniques (described method versus our modified method) with respect to the success rate and time required for the procedure.

Materials and methods

Dogs which had recently died or which had been euthanatised for various reasons were obtained from the university clinics. Sixty dogs of various ages, breeds, sizes and both sexes were used. The bodyweight of the dogs ranged between 4 and 59 kg. The cadavers were either between body temperature and room temperature directly after death, or had been cooled. With cadavers in rigor mortis, before arthroscopy was performed, flexing and stretching of the shoulder joint was used to reduce stiffness. The dogs in which rigor mortis had not completely ‘set in’ were not used for arthroscopy. In order to investigate the influence of the bodyweight on the two methods, we established four categories (Table 1).

The triangulation technique (method 1 = M1) as described by Van Ryssen (10) was used to achieve a caudal working canal. On the other shoulder the arthroscope was inserted in the shoulder joint, but the triangulation technique used was modified by the authors (method 2 = M2).

All of the procedures were carried out by the same investigator. Before commencing the work described herein, this investigator had performed the conventional method (M1) on eight shoulder joints and – in the course of developing the target device – had performed the modified method (M2) on 12 shoulder joints of dog cadavers.

The following devices and instruments were used in the arthroscopic analyses:

- arthroscope (2.7 mm diameter, 140 mm working length, 30° angle) with arthroscopic sleeve (3.8 mm outside diameter, 120 mm working length with two-way stopcock) and 2 trocars (sharp and blunt)\(^a\)
- light source (Xenon-Praxis 6000 K°, 150 W, 230 VAC, 50-60 Hz)\(^b\)
- fiber light cable (3.5 mm diameter, 230 cm length)\(^c\)
- camera and camera head (1/2 CCD color video camera, VHS, min. photosensitivity 2.5 Lux, 230 VAC, 50/60 Hz)\(^d\)
- monitor (36 cm, PVM1453, MedGV)\(^e\)
- video recorder (S-VHS, PAL, 220-230 VAC, 50-60 Hz)\(^f\)
- digital still recorder (DKR-700P)\(^g\)
- pressure infusion cuff (1 liter volume, Unifusor 1000cc)\(^h\)
- infusion set with extension\(^i\)
- disposable injection needles (0.9/15003 40 mm; 0.9/15003 70 mm)
- pointed scalpel blades (no. 11)\(^j\)
- one working cannula with internal diameter 2.9 mm and 75 mm working length\(^k\)
- two working cannulas with 3.5 mm internal diameter and 68 mm working length: one with a 2-mm long and 1-mm wide spherical widening at the lower end of the working cannula (flared cannula), and the second with a straight shaft (regular cannula)
- sharp trocar for working cannulas\(^l\)
- changing rod for working cannulas (2.8 mm diameter, blunt at both ends)\(^m\)
- changing/puncture rod for working cannula and target device (2.8 mm diameter, one sharp and one blunt end)\(^n\)
- target device (of anodized aluminum) (Fig. 2)\(^o\)
- hook probe (2.2 mm diameter, 129 mm working length)\(^p\)

\(^a\) Dr. Fritz GmbH, Tuttlingen, Germany
\(^b\) Sony, Kitashinagawa, Japan
\(^c\) Panasonic Deutschland GmbH, Hamburg, Germany
\(^d\) Statcorp Inc., Jacksonville, Florida, USA
\(^e\) B. Braun Austria GmbH, Maria Enzersdorf, Austria
\(^f\) Gebrüder Martin, Tuttlingen, Germany
Procedure for the shoulder joint arthroscopy

The dog was placed in lateral recumbency with the leg to be used for arthroscopy uppermost. The surgical field was shaved and draped. The shoulder joint was held in a neutral position by placing a rolled drape with a diameter of 7 to 15 cm (depending upon the size of the dog) under the upper leg. The angle between scapula and humerus was 160°. The joint was punctured cranio-laterally between the acromion and the caudal part of the greater tubercle in a caudo-medial direction using an injection needle (0.9 mm diameter, 40 mm length) (Figs. 1 and 4), which later served as fluid outflow (egress needle). Synovial fluid was aspirated to confirm the intra-articular position of the needle. Depending upon the size of the dog, 8-10 ml of irrigation fluid (water) was subsequently injected via this needle, and the irrigation system linked to the pressure infusion cuff was connected to the needle. In this way the joint was distended with irrigation fluid. An injection needle of the same dimensions was then used to puncture the joint again, approximately 1.0 cm distally to the caudal edge of the acromion, and perpendicular to the skin surface and directed medially (Figs. 1 and 4). Outflowing irrigation fluid confirmed the correct intra-articular position of the needle. A stab incision was made with a pointed scalpel blade at the puncture hole of this cannula. Using a sharp trocar, the arthroscopic sleeve was inserted into the incision and into the joint. Next the trocar was replaced by the arthroscope, the light cable and the camera head were connected, and the irrigation system was connected to the arthroscopic sleeve. The joint was irrigated with water at a pressure of 20 mm Hg during the arthroscopic inspection of the joint and while a working cannula was inserted.

Method 1 (M1) — positioning the working cannula using the conventional triangulation technique

In order to establish an instrument portal, the caudal joint pouch was punctured with the 70 mm long, 0.9-mm injection needle at a position 2-4 cm (depending on the size of the dog) caudally and 1.0 cm distally to the arthroscopic sleeve. The correct position was confirmed when the needle could be seen with the arthroscope in the caudal pouch of the shoulder joint and irrigation fluid flowed from the needle. A stab incision was made with a pointed scalpel along the needle, and the needle was removed from the joint. A working cannula (inside diameter 2.9 mm) was inserted along the stab incision into the joint using a sharp trocar, and under arthroscopic control. After the working cannula reached the joint cavity, the trocar was removed and a changing rod was introduced. The 2.9-mm working cannula was pulled out of the joint over the arthroscopically visible changing rod and inserted in a 3.5-mm working cannula. Under arthroscopic control both working cannulas were inserted into the joint over the changing rod. The changing rod and the 2.9-mm working cannula were subsequently removed.

Method 2 (M2) — positioning the working cannula using the modified triangulation technique

For M2 the working cannula was also inserted in the caudal pouch of the shoulder joint using the triangulation method; however, a target device developed by the authors provided the correct position of the working cannula. This instrument was attached to the upper end of the arthroscopic sleeve (Fig. 3). Three essential requirements have to be met before puncturing the joint:

- The arthroscope is perpendicular to the skin surface (Fig. 4).
- By turning the light cable the viewing angle of the arthroscope is directed caudally, parallel to the joint space. This is confirmed by the notch at the edge of the arthroscopic picture (Fig. 5).
- The target device is at an angle of 180° to the light cable (Fig. 6).

Following the skin incision, the changing/puncture rod (sharp end first) was slowly pushed along a canal in the target device into the joint under arthroscopic control. In this way the changing/puncture rod was positioned directly in front of the optic tip (Fig. 3). The target device was disconnected from the arthroscopic sleeve and removed. The 2.9-mm working cannula was then pushed over the guiding changing/puncture rod into the joint, the changing/puncture rod was pulled out of the joint and reinserted blunt end first. The 2.9-mm working cannula was subsequently pulled over the changing/puncture rod out of the joint, placed into the 3.5-mm working cannula which had a widening at the lower end, and both working cannulas were inserted together into the joint (under arthroscopic control) over the changing/puncture rod. The changing/puncture rod and the smaller working cannula were then removed.

Important structures in the joint such as the caudal joint pouch, the joint surface of the humeral head, the glenoid cavity, the medial glenohumeral ligament, the biceps tendon and its origin and entry into the biceps tendon sheath, and the tendon of the subscapular muscle were visible by the arthroscope by means of both operating techniques.

The following parameters were used to compare the two methods:

- SUCCESS (SU): The parameter SU indicates whether it was possible to insert the working cannula within 16 minutes

Table 1  Dog categories and body weights (BW)

<table>
<thead>
<tr>
<th>Category</th>
<th>BW in kg</th>
<th>no. of dogs</th>
</tr>
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<tbody>
<tr>
<td>Category 1</td>
<td>1 - 9</td>
<td>6</td>
</tr>
<tr>
<td>Category 2</td>
<td>10 - 24</td>
<td>20</td>
</tr>
<tr>
<td>Category 3</td>
<td>25 - 40</td>
<td>22</td>
</tr>
<tr>
<td>Category 4</td>
<td>&gt; 40</td>
<td>12</td>
</tr>
</tbody>
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Kern & Sohn GmbH, Albstadt, Germany
or the injection needle (with M1) or the changing/puncture rod (with M2) with less than 50 trials into the caudal pouch (SU = 1) or not (SU = 0). If SU = 0, the insertion attempt was interrupted and the parameter TIME (TI) was recorded as 16.02 minutes and the parameter TRIALS (TR) was recorded as 51 attempts in the statistics. Further parameters could not be determined.

- **TIME (TI):** On successful insertion of the working cannula the TI in minutes was measured from when the arthroscope was correctly positioned to when the working cannula was visualized with the arthroscope in the caudal pouch.
- **TRIALS (TR):** The number of TR necessary in order to visualize the 70 mm long, 0.9-mm injection needle (method M1) or the changing/puncture rod (method M2) with the scope in the caudal pouch was recorded.
- **POSITION of the working cannula (POS):** On successful insertion, the quality of the POS was observed by using a test hook. The test hook was inserted into the working cannula and it was attempted to reach the following intra-articular structures:
  - The typical localization of an OCD in the caudodorsal area of the humeral head.
  - The caudoventral attachment of the joint capsule to the humerus.
  - The dorsocranial edge of the medial glenohumeral ligament.
  If it was possible to reach these structures using the test hook, the POS was rated as “good”. If this was not possible, the POS was rated as “bad”.
- **DAMAGE to the joint cartilage (DAM):** It was recorded if DAM occurred on insertion of the working cannula (DAM = 1) or not (DAM = 0).
- **FORCE (FOR):** To determine how well both the 3.5-mm working cannulas (flared and regular cannula) held in the joint capsule, the working cannulas were pulled out of the joint using a weight scale which displayed load in kilograms. In order to be able to attach the scale centrally to the cone of the working cannula in both of the methods, the loop of the handmade wire basket was passed.
around the base of the working cannula before the insertion of the 3.5-mm working cannula. The hook of the scale was hung in the middle of the wire basket. The working cannula was pulled out of the joint employing slowly increasing pressure on the scale and the required FOR was recorded (Fig. 7).

Statistical analysis

For all of the data, homogeneity of distribution was tested by the Kolmogorov-Smirnov-Test. If the data were normally distributed, we used a t-test or ANOVA analysis followed by a Duncan test. When there was not any normal distribution, the Kruskal-Wallis-test and, for paired samples, the Mann-Whitney-test were applied. For qualitative variables we used the chi-squared-test.

Results

In clinical practice arthroscopy of the shoulder joint is particularly performed on dogs with a body weight of more than 20 kg, and the dog categories 2, 3 and 4 are particularly interesting for the statistical evaluation. The results of category 1 were very different to the other categories in favour of Method 2. For this reason, in the comparison of the two methods with respect to TI and TR, category 1 was not included in the statistical calculations (Table 2).

- SUCCESS (SU): Comparing all of the dogs with method 1 (M1) and method 2 (M2), the parameter SU was 1 (SU = 1) in 52 shoulders out of 60 (equals 86.7 %) for method M1, and in 60 shoulders out of 60 (equals 100 %) for method M2. In eight of the dogs, M1 exceeded a maximum value of 16.02 minutes and a sample size of 51 attempts. In these eight cases SUC was zero (SU = 0). The eight failed attempts in M1 were distributed equally over all four categories, which means two cases in each category.
- TIME (TI): The mean of TI was 5.05 minutes for M1, and 1.34 minutes for M2 (Table 2). The mean of TI in category 1 for M1 was almost twice as high as in the other categories. The mean without category 1 (n = 6) was 4.68 minutes for M1, and 1.30 minutes for M2. Without taking into account dogs with negative SU (see above), the mean value for M1 was 3.37 minutes. The differences between the methods were highly significant in all cases.
- TRIALS (TR): The arithmetical mean of TR was 10.77 for M1, and 1.13 for M2 (Table 2). In this parameter the mean in category 1 for M1 was almost twice as
The mean in the categories 2 to 4 (n = 54) was 9.70 for M1, and 1.15 for M2. Without taking into account the dogs with negative SUC (see above), the mean for M1 was 4.58. The differences between the methods were highly significant in all cases.

**G POSITION of the working cannula (POS):** The POS was (compared with the complete number of samples) sufficient in 36 arthroscopic attempts in M1 (equals 60%), and in 57 arthroscopic attempts in M2 (equals 95%).

**G DAMAGE to the joint cartilage (DAM):** After insertion of the working cannula, damage in various degrees occurred in 39 cases (equals 65%) in M1 and in six cases (equals 10%) in M2.

**G FORCE (FOR):** The required FOR to pull the working cannula out of the caudal pouch of the shoulder joint was measured with electronic scales showing the weight in kg. For the regular cannula an average of 0.191 kg and for the flared cannula 0.350 kg was measured. There were statistically significant differences between the cannulas (p = 0.002).

The parameters POS and DAM showed strong interdependency (p = 0.025); if the position of the working cannula was unfavorable, cartilage damage occurred subsequently.

However, neither method showed any interdependency between the number of arthroscopies performed and TI. In other words, for both methods the investigator could not shorten the duration of the surgery with increased experience. Thus there was not a “learning curve”.

Three dogs showed marked exophytic growth on the caudoventral scapula and caudoventrally on the humeral head. These dogs were one dog each of categories 2, 3 and 4. The conventional triangulation technique (M1) could not be performed in the dogs described of category 3 und 4. The joint of one dog of category 2 was so small that the arthroscope repeatedly slipped out of the joint when the surgeon tried to visualize the 0.9 × 70-mm cannula arthroscopically. The triangulation was interrupted and the procedure was considered unsuccessful.

### Complications

During the development of the “target device”, the technique was tested using a prototype and the appropriate angle of the working cannula to the arthroscope was determined. During this development process the following complications arose:

- If the arthroscope was inserted too far cranially, the working cannula was also located too far cranially, whereby it was difficult to gain access to the caudal joint pouch.
- If the target device was not at an angle of 180° to the light cable or the viewing angle of the arthroscope was not parallel to the joint space, the changing/puncture rod hit structures of bone and thus could not be inserted into the joint.
- If the arthroscope was inserted too far caudally, it was not possible to visualize the joint surfaces of the humerus and scapula when the arthroscope was correctly angled at 90° to the skin surface.

Thus it was not possible to show the orientation of the joint space and the light cable could not be arranged parallel to the joint space. It was not possible then to puncture the caudal joint space. It is most important to avoid these mistakes when performing M2.

### Clinical study

The modified triangulation technique has already been performed in eight clinical patients. In all of the cases, the dogs showed a...
mild lameness of the affected forelimb while walking, but placed the foot when standing. Mediolateral shoulder radiographs of the affected joint showed a flattening or a subchondral radiolucity in the caudal part of the humeral head. In all of the cases, the diagnosis was OCD. In seven cases a dislocated joint cartilage fragment, which was cranially attached to the remaining joint cartilage, could be seen caudolaterally at the humeral head. Insertion of the working cannula was successful in all of the cases on the first trial (SU = 1, mean of TR = 1.00). Using the working cannula and grasping forceps, it was possible to remove the cartilage fragment arthroscopically in all of the cases. In one case, when we attempted to remove a loose joint body, joint collapse developed due to an outflow of irrigation fluid with subsequent reduction of the view. After the working cannula slipped out of the joint unintentionally, we were able to reinsert it with the puncture instrument after two attempts using the conventional method. Moreover, in this case, the loose joint body could be removed from the joint via the working cannula.

Discussion

The results show that method 2 (M2) was successful every time, independent of the body weight. Thus independent of the size of the dog, i.e. the target device is suitable for use in dogs of all sizes.

The time taken for M2 was much less than for method 1 (M1) (Table 2). A longer manipulation time means a greater number of attempts to puncture the caudal joint pouch, thereby causing greater tissue trauma. It can therefore be expected that a longer manipulation time would lead to greater post-operative pain. Thus it can be speculated that arthroscopy with M2 leads to a shorter convalescent period. The shorter anaesthetic period for M2 minimizes the anaesthetic complications and could enable arthroscopy to be carried out also in high-risk patients. Furthermore, through the shorter anaesthetic period a bilateral treatment is possible in one surgical session. For both M1 and the modified triangulation technique (M2), TI did not display a “learning curve”, i.e. no reduction in the operating time with increasing surgical experience. It can be concluded from this that M1 also proved difficult for experienced surgeons.

The major advantage of M2 is that puncturing the caudal joint pouch is nearly always successful on the first trial (Table 2). Because the aim is more accurate, muscles and joint capsule are only traumatized by one puncture, and blood vessels (caudal circumflex humeral artery and vein) and nerves (axillary nerve) are less likely to be damaged. Reduced tissue trauma most likely leads to less post-operative pain and thereby to a shorter recovery time for the patient. Furthermore, because the joint is not punctured repeatedly, the risk of irrigation fluid leaking from the joint is reduced. If, while manipulating the surgical instruments in the joint, the working cannula slips out of the joint, with M2 it can be reinserted accurately, without the repeated puncture attempts which were often required with M1, in the same way as it was punctured the first time. The repeated puncture attempts often required during M1 cause greater trauma to muscles and joint capsule and, if the aiming is not optimal, can traumatize the blood vessels and nerves mentioned above. Furthermore, with M1 the joint capsule is punctured more than once, resulting in the leakage of irrigation fluid into the periarticular tissue. This leads to some degree of joint collapse and obstruction of visibility, which means that, in extreme cases, the operation cannot be continued.

Due to the better placement in the joint of the working cannula inserted with M2, and the good access to the described structures in the joint, the field for surgical intervention is enlarged with this method. Loose bodies in the area can be grasped and removed and joint surfaces to be curetted can readily be reached.

In contrast, poor placement of the working cannula, which occurred more frequently with M1 than M2, can necessitate renewed insertion of the cannula and thus extend the operation time, threaten the success of the operation and traumatize soft tissues.

Damage to articular cartilage through the insertion of the working cannula occurred considerably less frequently with M2 in contrast to M1. Thus additional trauma to the joint is avoided and we believe that a faster and better recovery of the patient can be expected.

By using a working cannula with a spherical widening at the end of the shaft, the force required to remove the working cannula from the joint is greater. Thus compared to the regular cannula, the flared working cannula sits more tightly in the joint, and cannot as easily be accidentally pulled out of the joint when surgical instruments are removed or tissue is extracted. This avoids periarticular leakage of the irrigation fluid through the perforation in the joint and the need for a renewed insertion of the working cannula, whereby all the complications described above are avoided. However, it can be assumed that, if the flared cannula slips out of the joint, it leaves a greater defect in the joint capsule than the regular cannula and thus the extent of the resulting joint collapse could be greater.

Because the reasons for the complications were identified and eliminated, the complications mentioned in the results section did not occur in the course of this work.

In conclusion, the modified method, in comparison with the conventional method, can be performed with more success and fewer complications and is faster and simpler as well.

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References


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BOOK REVIEW

L. P. Case

The Cat: Its Behaviour, Nutrition and Health
392 pp; Illustrations by Kerry Helms and Bruce MacAllister
Ames, IA: Iowa State University Press, 2003

This book was written as an introductory textbook for undergraduate animal science courses and veterinary technician programmes, and as reference book for breeders, groomers, cat enthusiasts, and veterinary practitioners. The result is an exceptionally well-written, concise but comprehensive, scientific overview of the cat.

The text is divided into four parts. The first, ‘Knowing the Cat within the Companion’, has six chapters covering domestication, selective breeding, environmental perception, reproduction, genetics and the human-cat relationship. The second part, ‘Behavior: Understanding the Domestic Cat’, covers development, social life, learning and training, and behavior problems. The third part, ‘Health and Disease: Keeping Cats Healthy and Happy’ deals primarily with infectious diseases. Although the last chapter covers first aid procedures for trauma, choking, heat stroke, burns, arthropod envenomation and poisoning. The last part, ‘Nutrition: Feeding Cats for Health and Longevity’, contains chapters on principles of nutrition in a feline context, diet selection for various stages of development, and dietary therapy. The book also possesses a glossary (the words found in the glossary are bolded in the main text), and a comprehensive index. The information is clearly presented, it is well-referenced, and the book is a pleasure to read.

The reviews of diseases are generally complete and accurate. One notable omission from the list of toxic plants are Easter Lilies and related plants that may cause acute renal failure. And while drug therapy is not discussed in the book, given that this text is also offered as a resource to lay people, the toxicity of over-the-counter medications, in particular acetaminophen, should perhaps have been included.

The book is not extensively illustrated, but any illustrations are nicely created pencil drawings or diagrams. The tables are well-designed and contribute to comprehension of the material.

This book is to be recommended for all people who work with cats – there is something for everyone in this book, and appropriate recommendations for further reading for those who wish to do so. The author’s goal of providing a textbook for undergraduate and technical programmes is amply achieved. For veterinarians, the discussions of normal behaviour and nutritional principles provide valuable information. And, while there are other sources that deal with behavioural disorders, infectious diseases, and dietary therapy in more detail, the material presented provides useful concise reviews. However, the most valuable information is perhaps in the first part, some of which veterinary practitioners may have either forgotten or never learned; it is truly enjoyable to read.