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1 Challenges in evaluation of pain and a pre-incisional line block

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14

15 Abstract

16 Background: Our objective was to test the effectiveness of a local anesthetic line block  
17 administered before surgery in reducing postoperative pain scores in dogs undergoing  
18 ovariohysterectomy (OVHX). This study was a prospective, randomized, blinded, clinical  
19 trial involving 59 healthy female dogs. An algometric pressure-measuring device was  
20 used to determine nociceptive threshold, and compared to three subjective pain scales.

21 Group L/B received a line block of lidocaine (4 mg/kg) and bupivacaine (1 mg/kg)  
22 subcutaneously in the area of the proposed incision and saline subcutaneously as  
23 premedication; group L/BM (positive control) received a similar block and morphine (0.5  
24 mg/kg) subcutaneously for premedication; and group SS (negative control) received a  
25 saline line block and saline premedication. Criteria for rescue analgesia were defined  
26 before the study. Dogs were assessed prior to surgery, at extubation (time 0) and at 2, 4,  
27 6, 8 and 24 hours post-recovery. The data were analyzed with one-way ANOVA, and a  
28 repeated measures ANOVA with one grouping factor and one repeat factor (time).  $P <$   
29 0.05 was considered statistically significant.

30 Results: Pain was so subtle that there were no significant differences between treatment  
31 groups with any assessment method, and no significant difference between positive and  
32 negative controls.

33 Conclusions: Pain in non-verbal responders is subtle, even in animals with a known  
34 painful stimulus. Pre-emptive, intraoperative and post-operative analgesia is necessary  
35 regardless of pain score within the first 24 hours. None of the pain scales evaluated were  
36 sensitive enough to determine pain in all animals in this study.

37

38 Key words: Dog, lidocaine, bupivacaine, local anesthetic, pain assessment

39

40 **Introduction**

41 As any verbal responder who has experienced pain may attest to, pain decreases  
42 quality of life . Therefore, pain management in patients experiencing pain is crucial for  
43 improving quality of life. Pain management of non-verbal patients is uniquely  
44 challenging because the ability to effectively diagnose and treat pain becomes very  
45 subjective. Pain assessment in non-verbal species has been investigated along three  
46 principal lines: a) objective measures of physiologic responses to experimental pain, b)  
47 subjective or semi-objective assessment of behavior postoperatively, and c) quantitative  
48 measures of postoperative behavior and physiology. While studies using objective  
49 physiological data (i.e. variables such as heart rate, respiratory rate and blood pressure)  
50 are easy to perform and analyze statistically, there is minimal evidence that these  
51 measures are reliable indicators of pain (2, 3). Most peer-reviewed research studies in  
52 veterinary medicine use subjective or semi-objective assessments of postoperative pain or  
53 sensitivity of an anatomical site to assess outcomes.

54 Algometers are devices used to quantitate pressure required to elicit a response  
55 from a subject; this is termed “nociceptive threshold”. Algometers provide a (partially)  
56 objective measurement of incisional sensitivity. The “threshold” reading is numeric and  
57 objective, but the factor determining the threshold (behavioral response) is subjective.  
58 Various mechanical threshold devices are validated to assess somatosensory processing  
59 changes (4).

60 Multimodal analgesia is the combination of analgesic drugs with different  
61 methods of action, with the goal of reducing or preventing nociceptive stimulation at  
62 multiple receptors and pathways. In humans, multimodal analgesia has been shown to

63 decrease post-operative morbidity and mortality, improve quality of life and patient  
64 satisfaction, and decrease the associated costs to hospitals and insurance companies (5).  
65 In addition to the general agreement of a clinical benefit to this approach (6), there are  
66 also an increasing number of research studies in non-verbal species supporting  
67 multimodal analgesia (8-10). One simple way to include multimodal analgesia is the  
68 incorporation of a local anesthetic to desensitize a specific region, in combination with  
69 systemic analgesic administration.

70 This study was designed to assess the effect of pre-incisional administration of a  
71 combination of local anesthetics on post-operative pain, measured by subjective and  
72 objective pain scores after canine ovariohysterectomy (OVHX). We hypothesized that  
73 pre-incisional infiltration of the incision area with local anesthetic agents (group L/B)  
74 would result in similar post-surgical pain levels compared to animals receiving local  
75 anesthetic and an opioid (group L/BM), and decreased post-surgical pain compared to  
76 animals not receiving any pre-operative analgesics (group SS).

## 77 **Materials and methods**

78 This study examined 59 healthy intact female dogs admitted to a local animal  
79 shelter (Sacramento Society for Prevention of Cruelty to Animals [SPCA], Sacramento,  
80 CA, USA), ranging in age from six months to eight years old with weights ranging from  
81 3.4–35.5 kg. A physical examination was performed, and temperature, heart rate, and  
82 respiratory rate were recorded prior to sedation for anesthesia and surgery. Each dog had  
83 a packed cell volume (PCV), total protein (TP), and blood urea nitrogen (Azostick, Bayer  
84 Corporation, Elkhart, IN, USA) checked prior to surgery. Please see Table 1 for a  
85 summary of baseline data. No dogs with abnormal physiologic parameters, abnormal

86 blood tests, evidence of a previous OVHX, or requiring extension of the incision beyond  
87 the blocked area were used in this study. All protocols were approved by the University  
88 of California, Davis, Institutional Animal Care and Use Committee, as well as by  
89 administrative study reviewers at the Sacramento Society for Prevention of Cruelty to  
90 Animals (SSPCA).

#### 91 Anesthesia

92 Dogs were allocated into one of three groups using a computer generated  
93 randomized block design. All three groups were sedated with acepromazine  
94 (Acepromazine maleate, Vedro, St. Joseph, MO, USA) (0.03 mg/kg, subcutaneously  
95 [SC]) administered prior to catheter placement. An 18-22-gauge (depending on the  
96 animal's weight) over the needle IV catheter was placed in a cephalic vein for drug and  
97 fluid administration. Anesthesia was induced with propofol (Diprivan, AstraZeneca LP,  
98 Wilmington, DE, USA) to effect and maintained with isoflurane (Isoflurane, Abbot  
99 Laboratories, North Chicago, IL, USA) in oxygen to effect. Lactated Ringer's solution  
100 was administered at 10 mL/kg/hour until recovery. Heart rate, respiratory rate, and  
101 systolic blood pressure were monitored throughout the procedure.

102 Dogs in group L/B received a line block prior to surgery in the incision area, consisting  
103 of 4 mg/kg lidocaine (Lidocaine, Hospira Inc., Lake Forest, IL, USA) and 1.0 mg/kg  
104 bupivacaine (Bupivacaine, Hospira Inc., Lake Forest, IL, USA). These dogs also received  
105 0.05 mg/kg of saline SC at the same time as acepromazine administration. Group L/B  
106 were test subject dogs, to compare to positive and negative control groups. Dogs in the  
107 group L/BM received a line block prior to surgery, using 4.0 mg/kg lidocaine and 1.0  
108 mg/kg bupivacaine. These dogs also received 0.5 mg/kg of morphine (Morphine sulfate,

109 Baxter Health Care Corporation, Deerfield, IL, USA) SC at the same time as  
110 acepromazine administration. Group L/BM was the positive control group (i.e. dogs  
111 anticipated to have minimal pain). Group SS was the negative control group (i.e. dog  
112 anticipated to have pain). Dogs in group SS received 0.275 mL/kg of normal saline prior  
113 to surgery in the incisional area. These dogs also received 0.05 mg/kg of saline SC at the  
114 same time as acepromazine administration. Because we anticipated painful animals,  
115 criteria for rescue analgesia were defined prior to the study's commencement and strictly  
116 adhered to. The line block or saline (depending on the group) was administered after  
117 induction of anesthesia and initial surgical preparation of the field, approximately five  
118 minutes prior to surgical incision.

#### 119 Line block procedure

120 Appendix 1 shows the line block in schematic form. Local anesthetic or saline  
121 (depending on the group) was infused with a 2.5 inch, 22-gauge spinal needle in three  
122 separate lines to form an inverted double "L" administration site. One third of the volume  
123 of drug or saline was administered at each site, as volume allowed. The level of the first  
124 line (Appendix 1, "1") was roughly halfway between the umbilicus and the first set of  
125 nipples below the umbilicus; placement was guided by consultation with the surgeon  
126 prior to incision to ensure coverage of the area to be incised (Appendix 1, "A"). The  
127 width of this first line ran mediolaterally for approximately 1.25 cm on either side of  
128 midline. The second line (Appendix 1, "2") began at the left-most lateral point of the first  
129 line, and ran craniocaudally for the length of the spinal needle on the left side of midline.  
130 The third line (Appendix 1, "3") paralleled the second on the right side of the umbilicus.  
131 In Appendix 1, "B" denotes the pubis. These blocks were administered in the



132 subcutaneous and fascial planes. Aspiration prior to administration of the block was  
133 performed to ensure the drugs were not given intravenously.

134 Surgical procedure

135 The hair was clipped from the xiphoid process to the pubis and three cm laterally  
136 to the nipple on both sides of the abdomen. The skin was scrubbed with chlorhexidine  
137 and rinsed with water 3 times. The line block was applied after initial preparation;  
138 additional preparation followed until the area was aseptically prepared. An incision was  
139 made extending below the umbilicus to one-third the distance from the umbilicus to the  
140 pubis. An OVHX was performed in a standard fashion (10) by one of three experienced,  
141 shelter veterinary surgeons. The skin was closed in a routine manner.

142 Assessment

143 Four pain scoring assessments were used; initial values for each were recorded  
144 prior to the sedation of the animal for anesthesia and surgery (time negative one).  
145 Assessments were then made at zero (time of extubation), two, four, six, eight, and 24  
146 hours postoperatively by one veterinarian (CMM) who was blinded to which treatment  
147 group each animal was in. Caretakers made additional assessments during the day when  
148 animals were handled, to ensure any animal that needed additional analgesia would  
149 receive it.

150 The first pain scoring assessment was a visual analog scale (VAS) score. This  
151 assessment was made prior to any manipulation or handling of the animal. A mark on a  
152 ten centimeter (cm) line corresponded to the assessor's visual assessment of the animal's  
153 pain, ranging from zero ("not painful") to ten cm ("the most pain an animal could

154 possibly be in”), measured in mm using a standard ruler at each scoring assessment, and  
155 recorded after each measurement was taken.

156 The next two pain scoring assessments were done sequentially. One of these pain  
157 scales was based on a previously validated scoring system, the Glasgow Composite Pain  
158 Scale (GCPS,  
159 <http://www.gla.ac.uk/faculties/vet/smallanimalhospital/ourservices/painmanagementanda>  
160 [cupuncture](#), subheading: Short form pain questionnaire). The primary variables included  
161 vocalization (quiet, crying, groaning, screaming), attention to painful area (ignoring,  
162 looking, licking, rubbing, or chewing), mobility (normal, lame, slow or reluctant, stiff, or  
163 refusal to move), response to touch (none, looking around, flinch, growl, snap, or cry),  
164 demeanor (happy and content, bouncy, quiet, non-responsive or indifferent to  
165 surroundings, nervous or anxious or fearful, or depressed or non-responsive to  
166 stimulation), and posture (comfortable, unsettled, restless, hunched or tense, or rigid).  
167 Additional assessment was made using the University of Melbourne Pain Scale (UMPS)  
168 (11). The primary variables included physiologic data (dilated pupils, percentage increase  
169 in heart rate, percentage increase in respiratory rate, rectal temperature, salivation),  
170 response to palpation (no change, guards/reacts when touched, guards/reacts before  
171 touched), activity (at rest [sleeping or semiconscious, awake], eating, restless [pacing,  
172 getting up and down], or rolling/thrashing), mental status (submissive, overtly friendly,  
173 wary, or aggressive), posture (guarding or protecting affected area, recumbency, standing  
174 or sitting with head up, standing with head down, moving, or abnormal body posture  
175 [prayer/hunched]), and vocalization (none, vocalizing when touched, intermittent  
176 vocalization, or continuous vocalization).

177 The final assessment method used a digital von Frey apparatus (IITC 2390 Series  
178 Electronic Von Frey Anesthesiometer, Woodland Hills, CA, USA) (13). The tip of the  
179 von Frey apparatus was placed one cm adjacent to the center of the incision. It was  
180 pressed with a slow, continuous pressure until a response was noted, with a maximal  
181 force of 1000 g. A response was considered an acknowledgement that the stimulus was  
182 noxious; this included behaviors such as withdrawing from the stimulus, a cry, active  
183 head turn to the stimulus, attempt to bite, etc. This measurement was repeated three times  
184 at five-minute intervals, and each value was recorded as force in grams. The average  
185 value of these three readings was used in the data analysis. At each time point, algometer  
186 measurements were also taken from the lateral thoracic wall in the same manner. These  
187 measurements, as well as pre-sedation measurements, acted as controls for analysis.

#### 188 Rescue analgesia protocol

189 All animals were assessed by the observing veterinarian (CMM), and rescue  
190 analgesia (0.5 mg/kg morphine IM) was administered to any animal that achieved a  
191 maximum score in any one category of the GCPS, any animal with a pain score of 8 or  
192 greater on the GCPS or who did not improve over time as compared to pre-sedation  
193 GCPS score, any animal developing aggression, or a combination of these previous  
194 factors. Animal handlers at the SPCA also had the opportunity to declare an animal as  
195 being in pain, based on their observation, and these animals also received rescue  
196 analgesia. Administration of rescue analgesia and the reason for administration was  
197 recorded, and these animals were included in assessments; see “Blinding, exclusion  
198 criteria and statistical analysis”. Any animal receiving rescue analgesia was reassessed 30  
199 minutes later to ensure efficacy of the rescue analgesia administration.

200 Blinding, exclusion criteria, and statistical analysis

201           The evaluator (CMM) was blinded to which dog was in which group (i.e. L/B,  
202 L/BM or SS) as well as to whether a placebo or a study drug was contained in a particular  
203 group. The statistician who performed the data analysis remained blinded to which study  
204 drug was contained in each group until the analyses were completed.

205           Initial power calculations were performed prior to commencing the study, with  
206 significance set at 0.05 and power set at 0.8. An alpha error level was set at 5%. Standard  
207 deviation was set at 1.8 Glasgow Composite Pain Scale units. A beta error level was set  
208 at 20%. These calculations indicated the need for approximately 19 dogs in each group to  
209 find significant differences in our study populations, assuming a difference of 2.6 on the  
210 Glasgow Composite Pain Scale as being significant (13). The groups were analyzed for  
211 differences in age, weight, preoperative temperature, heart rate, respiratory rate, BUN,  
212 PCV/TS, propofol dose [mg/kg], and time negative one algometric values, by means of  
213 one-way ANOVA. Normality of the errors was assessed by visual inspection of a  
214 histogram of the errors and a normal probability plot. Errors were considered normal if  
215 the histogram was unimodal and approximately symmetrical (14), and the normal  
216 probability plot was an upwardly sloping, approximately straight line. Homogeneity of  
217 variance was tested by means of a studentized residual vs. means plot. The response  
218 variable of treatment groups was analyzed by means of a repeated measures ANOVA  
219 with one grouping factor and one repeat factor (time). Those dogs receiving rescue  
220 analgesia were analyzed in a similar fashion in two separate analyses: within their  
221 collective treatment group and as a separate subgroup.  $P < 0.05$  was considered  
222 statistically significant.

## 223 **Results**

224           There were 20, 19 and 20 dogs in Groups L/B, L/BM, and SS, respectively, for a  
225 total of 59 dogs. Twenty of the 59 dogs initially enrolled, required rescue analgesia  
226 (seven, three and ten dogs in groups L/B, L/BM, and SS, respectively, with no significant  
227 differences in the proportion requiring rescue analgesia between groups). Of all the  
228 predetermined rescue analgesia criteria, the only criteria triggering administration of  
229 rescue analgesia were animals that achieved a maximum score in any one category  
230 (mobility: refusal to move) of the GCPS and animals developing aggression. The  
231 majority of the dogs requiring rescue analgesia required it at time 0 (extubation; 18 of 20  
232 dogs) for refusal to move. All fifty-nine dogs were included in the analysis; additional  
233 analysis of the separate subgroup of dogs who received rescue analgesia showed similar  
234 results to the analysis of all 59 dogs, but the low numbers of dogs remaining in the groups  
235 after removal of those requiring rescue analgesia brought into question the validity and  
236 precision of the statistical analyses (therefore, data not shown).

237           VAS, GCPS, and UMPS analyses showed no significant difference in pain scores  
238 between treatment groups, and there was a significant effect of time (i.e. a decrease in  
239 pain scores over time; Figures 1, 2, and 3). Algometric values were compared to one of  
240 two controls. Regardless of whether the value obtained at the wound was compared to the  
241 thoracic measurement obtained at the same time or compared to the pre-incisional control  
242 reading (i.e. measurement at abdomen / control measure), there was no significant  
243 difference in values obtained between treatment groups, and there was a significant effect  
244 of time (i.e. a decrease in pain scores over time; Figures 4 and 5).

## 245 **Discussion**

246 We chose three different groups to test the efficacy of our line block to improve  
247 postoperative pain scores and algometric values. One group of animals (L/BM) was  
248 selected to receive morphine premedication to serve as the positive control group (i.e. the  
249 group anticipated to have the best analgesia). The group of animals that did not receive  
250 analgesia (SS) served as the negative control (i.e. the group anticipated as painful). The  
251 treatment group of interest, L/B, was evaluated in comparison to these positive and  
252 negative controls. The most profound result of our study was the lack of statistically  
253 significant differences between our positive and negative control at any given time point;  
254 that is, there was no statistically significant difference between an animal that received no  
255 pre-emptive analgesia and an animal receiving a full mu opioid to provide analgesia,  
256 using any of the assessment methods. This result was surprising, not only from the  
257 perspective of rendering the effects of treatment only speculative, but also in the  
258 implications this possesses for investigators researching pain in non-verbal species.

259 There are a number of potential reasons for the results obtained. Study design is  
260 critical to successfully identifying targeted outcome. One potential reason no significant  
261 difference between pain scores for any treatment group was evident was the number of  
262 dogs included in the study, thus limiting statistical power of our study. Our initial sample  
263 size calculations potentially hindered the study in two ways. Firstly, we applied sample  
264 size calculations meant for two groups to three groups. In retrospect, in order to correctly  
265 calculate our initial sample size, we would modify alpha ( $P=0.05$ ), with three groups and  
266 the number of potential comparisons (3), and therefore use an alpha value of 0.017  
267 ( $0.05/3$ ); this was not done. Secondly, our initial sample size calculations used a  
268 difference in the GCPS of 2.6, based on previous work (13). This was regarded as the

269 minimum difference that would be clinically relevant. |The differences in pain scores in  
270 our study were smaller than this (Figure 2) and while increasing the number of animals  
271 treated may possibly have reached statistical significance it would still have had little  
272 relevance for the clinician. Additionally, because we cannot account for Type II error, our  
273 statistical analysis is not conclusive.

274 The other aspect of study design was the intent to maximize the potential for  
275 successful pain identification, and thus the inclusion of one group that did not receive any  
276 preemptive analgesic medication (negative control). This decision was not made lightly,  
277 and the criteria were very strict for the use of rescue analgesia because of this. Even in  
278 light of this group that intentionally included, albeit aggressively managed for, pain, there  
279 was still no significant difference between the negative and positive control groups.

280 It may be that the dogs in this study were experiencing little discomfort, making it  
281 difficult to distinguish between the treatment groups. While this may seem unreasonable  
282 in regards to an intra-abdominal procedure, pain scores on the only validated scoring  
283 system (GCPS) were very low, never achieving a score of greater than five out of a  
284 maximal value of 24 at any one time point. A study evaluating intervention levels using  
285 the GCPS suggested intervening if a score of six out of 24 was obtained; the GCPSs  
286 values obtained in the present study were below this threshold (15). With such low pain  
287 scores, it was difficult to establish differences between the treatment groups. The low  
288 pain scores may have been due to the highly experienced veterinarians who were  
289 performing the OVHX creating minimal tissue trauma during surgery (and thus minimal  
290 pain associated with the surgery). In this study, the three surgeons were shelter  
291 veterinarians who performed up to 40 surgeries on any given day with over 30 years of

292 combined experience between them; surgery time ranged from 11 to 47 minutes, with an  
293 average surgery time of 21 minutes. This is considerably less than the average time of  
294 140 minutes for a veterinary student to spay a dog (16). If a group of less experienced  
295 surgeons—for example, veterinary student surgeons—performed the procedures, more  
296 detectable differences may have arisen. There is extensive debate about this subject,  
297 further complicated by a lack of reporting surgeon experience level in well-performed  
298 pain studies. At least one study specifically examining surgeon experience level  
299 suggested experience level of the surgeon was not correlated with a change in  
300 postoperative pain score (17). However, recent basic science evidence underscores the  
301 importance of deep tissue trauma to the experience of pain (18). Basic science work also  
302 supports this on a receptor level: surgical tissue injuries enhanced the membrane  
303 translocation of receptors important in post-operative hypersensitivity (19). Surgery  
304 performed by experienced surgeons, as was the case in this study, may reduce post-  
305 operative pain(21, 22) to levels below the sensitivity of current pain assessment scales.

306 Another reason for low pain scores on various scales may be due to inherent  
307 insensitivity of the measurement techniques, preventing a significant difference between  
308 positive and negative controls. Surprisingly little work has been performed to produce  
309 validated assessment systems for acute pain, with the Glasgow Composite Pain Scale  
310 standing out as the most validated scale in this regard (13). However, this scoring system  
311 was validated using a variety of surgical procedures, including orthopedic procedures.  
312 Additionally, the GCPS has not undergone criterion validation testing. It is possible that a  
313 dog undergoing OVHX by an experienced veterinarian may have signs of pain more  
314 subtle than this assessment instrument can detect. The von Frey apparatus was sensitive



315 to changes in threshold testing with dogs given 1 mg/kg morphine (12), and appears  
316 reliable in clinically normal dogs (4). However, data gathered by one of the authors  
317 (BDXL) found no difference in von Frey thresholds when it was used to assess wounds  
318 being infused with saline or with local anesthetic (23). This suggests that the von Frey  
319 may not be the appropriate instrument for assessing sensitivity of clinical wounds.  
320 Testing site could make a difference in the reliability of the algometer, as previous  
321 reports suggest that the canine carpal pad may be the most satisfactory site for testing (13,  
322 21). Because this location was considered unusual for testing sensitivity of an abdominal  
323 wound, it was not used for either the control or the test site, which may contribute to the  
324 difficulty of using the algometer for assessment. This topic needs further research to  
325 understand why the results appear counterintuitive, and to understand appropriate means  
326 to assess wound sensitivity.

327         There is no doubt that expertise of the assessor in regards to pain assessment plays  
328 a major role, as evidenced by a single experienced anesthesiologist finding a statistically  
329 significant improvement after an incisional block with bupivacaine in dogs undergoing a  
330 celiotomy (22). As involved as veterinarians are in the care of animals on a daily basis, it  
331 is still possible to misclassify an animal as not in pain for many reasons — including  
332 temperament, breed, type of surgery, and surgeon experience. In a study comparing staff  
333 observations versus a self-report of pain in young children, staff observations of pain  
334 were generally lower than the self-reports (26). However, for animals there is little  
335 alternative to an observer for pain assessment. The negative aspects of such a  
336 misclassification are obvious. The inclusion of multiple pain assessment tools with very  
337 defined criteria was intended to counter potential inexperience, but cannot negate the

338 possibility altogether. Although the differences in the three reduced-size groups that  
339 received rescue analgesia failed to reach statistical significance, the difference between  
340 the L/BM group and the SS group (16% vs. 50% treated), if real, is clinically important  
341 and suggests that the clinical judgment of when to administer rescue analgesia includes  
342 factors that are not captured in the scoring systems that were used. We elected to give  
343 rescue analgesia to any patient with a maximum value in any one GCPS category (27-  
344 29), as a means to favor generous administration of rescue analgesia for any patient who  
345 might need it. Our decision to give rescue analgesia to patients with a maximum value in  
346 any one GCPS category may have biased our results, as 18 of 20 dogs received rescue  
347 analgesia for a maximum value in the category of refusing to move post-surgery.

348 However, given the large number of patients in group SS that received rescue analgesia  
349 (almost half of the animals in that group), it is possible that refusal to move may be a  
350 sensitive indicator of patient discomfort in the patient with pain secondary to an OVHX.

351       The effect of time present (i.e. a decrease in pain scores over time) in this study  
352 suggests that we do see changes in pain scale scores and von Frey readings over the  
353 course of a 24-hour period. Using subjective pain scores, all values returned to baseline  
354 or near baseline by 24 hours, suggesting that we could no longer detect pain effectively at  
355 that point. When assessing algometric scores, there was an initial decrease from baseline  
356 after extubation, and while values tended to move back towards baseline between eight  
357 and 24 hours, the values never returned to baseline. This suggests wound sensitivity may  
358 still be present when subjective assessments do not detect pain. An alternative  
359 explanation is that the dogs had become behaviorally sensitized to the testing device.  
360 Ideally, testing of dogs that were not operated on would have been performed to evaluate

361 the effect of time on threshold readings. Data (30) suggest there is a learned response that  
362 decreases thresholds over time in normal dogs, but the data were generated using a more  
363 blunt device than the von Frey used in the present study.

364 No adverse events were documented in this study to suggest that a local anesthetic  
365 infiltrative block is harmful to a patient, as opposed to another study examining incisional  
366 line block (31). Fitzpatrick et al. (2010) may have seen greater complications because  
367 they choose to infiltrate the site of the incision, where as we infiltrated the tissue  
368 surrounding the incision. The block took a short time (<2 minutes) to perform. Other  
369 studies have found that incisional blocks provide effective analgesia (25, 32).

#### 370 Conclusions

371 We believe we cannot make firm conclusions about whether or not a line block is  
372 effective due to the lack of statistically significant differences between positive and  
373 negative controls. Indeed, the ability to assess pain in non-verbal species even with  
374 multiple assessment tools is called into question with the results of this study,  
375 necessitating a humble and compassionate approach to pain management in all non-  
376 verbal species.

377 The veterinary medical profession must work towards developing more sensitive  
378 and specific assessments of pain to evaluate the effectiveness of postulated analgesic  
379 interventions, while continuing to provide conscientious therapy knowing such strategies  
380 have not yet been developed. If an experienced observer cannot detect a patient with  
381 known pain from one that received adequate analgesia using four different techniques, it  
382 is relatively easy to miss a painful patient that cannot self-communicate. If one is

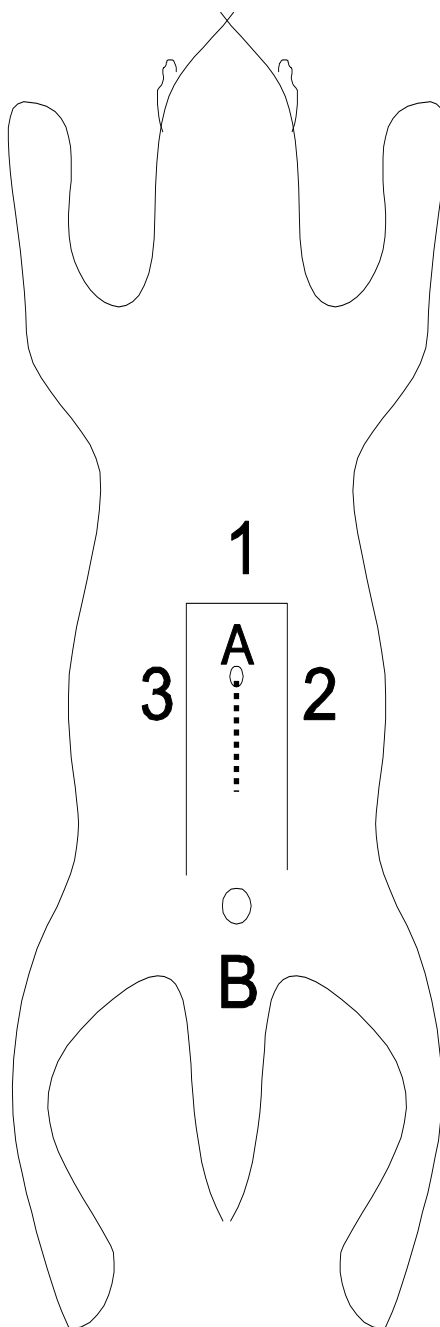
383 inducing something that is likely painful, aggressive pain management is warranted as a  
384 moral and ethical obligation.  
385

386 Appendix 1: Site for line block/infiltration of local anesthetic or saline. Please see text for  
387 description of labels.

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Table 1. Baseline data for Groups L/B, L/BM, and SS. Data is presented as average ( $\pm$ SD), except for BUN, where average value only is listed. Respiratory rate was not included because a large number of animals were panting.

Group	L/B	L/BM	SS
Number of dogs	20	19	20
Age	1.6 $\pm$ 1.7	1.6 $\pm$ 1.4	2.3 $\pm$ 2.0
Weight	17 $\pm$ 6.8	16.5 $\pm$ 1.4	18.2 $\pm$ 9.6
Temperature	101.2 $\pm$ 1.0	101.1 $\pm$ 0.9	101.1 $\pm$ 1.0
Heart rate	140 $\pm$ 22	138 $\pm$ 26	138 $\pm$ 22
PCV	43 $\pm$ 4.0	42 $\pm$ 4	42 $\pm$ 4
Total protein	6.8 $\pm$ 0.6	6.8 $\pm$ 0.7	6.5 $\pm$ 0.6
BUN (Azostick)	5-15	5-15	5-15
Propofol (mg/kg)	4.6 $\pm$ 1.1	4.3 $\pm$ 1.6	3.6 $\pm$ 1.6



## Figure Legends

Figure 1. Visual Analogue Scale (VAS), from 0-10 centimeters, prior to premedication (time -1), extubation (time 0), and 2, 4, 6, 8 and 24 hours post-operatively. Note: L/B received saline premedication and local anesthetic line block, L/BM received morphine premedication and a local anesthetic line block, and SS received a saline premedication and saline line block.

Figure 2. Glasgow composite pain scale (GCPS) scores from 0 to 24 prior to premedication (time -1), at extubation (time 0), and 2, 4, 6, 8 and 24 hours post-operatively. Note: L/B received saline premedication and local anesthetic line block, L/BM received morphine premedication and a local anesthetic line block, and SS received a saline premedication and saline line block.

Figure 3. University of Melbourne Pain Scale scores from 0 to 27 prior to premedication (time -1), at extubation (time 0), and 2, 4, 6, 8 and 24 hours post-operatively. Note: L/B received saline premedication and local anesthetic line block, L/BM received morphine premedication and a local anesthetic line block, and SS received a saline premedication and saline line block.

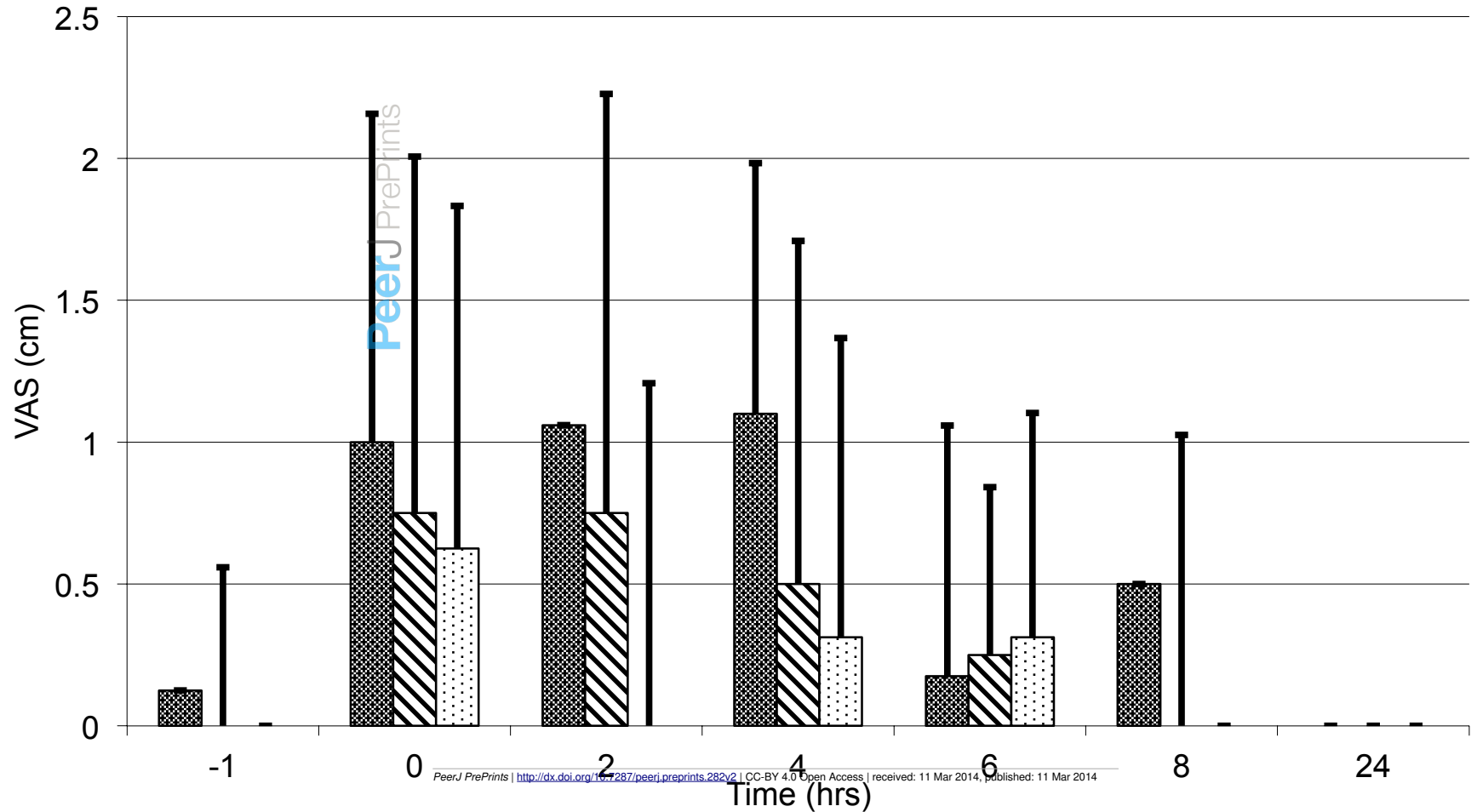
Figure 4. Algometric value, depicted as a ratio compared to the value obtained at the abdomen versus the value obtained at the thorax at the same time points: at premedication (time -1), at extubation (time 0), and at 2, 4, 6, 8 and 24 hours post-operatively. Note: L/B received saline premedication and local anesthetic line block, L/BM received morphine premedication and a local anesthetic line block, and SS received a saline premedication and saline line block. Also note that a ratio of one indicates the animal tolerates the same level of pressure on the

abdomen as the thorax. A decreasing ratio indicates the animal tolerates less pressure on the abdomen as compared to the thorax.

Figure 5. Algometric value, depicted as a ratio comparing the value obtained at each individual time point to values obtained at the abdomen prior to premedication (i.e. time, but not location, is the dependent variable). Time points for comparison to pre-medication values include pre-medication (time -1), extubation (time 0), and 2, 4, 6, 8 and 24 hours post-operatively. Note: L/B received saline premedication and local anesthetic line block, L/BM received morphine premedication and a local anesthetic line block, and SS received a saline premedication and saline line block. Also note that a ratio of one indicates the animal tolerates the same level of pressure on the abdomen at the time of comparison as it tolerated prior to incision. A decreasing ratio indicates the animal tolerates less pressure on the abdomen at the time of comparison as compared to pressure applied prior to the incision.

**Fig. 1**

▣ L/B  
▣ L/BM  
▣ SS



# Fig. 2

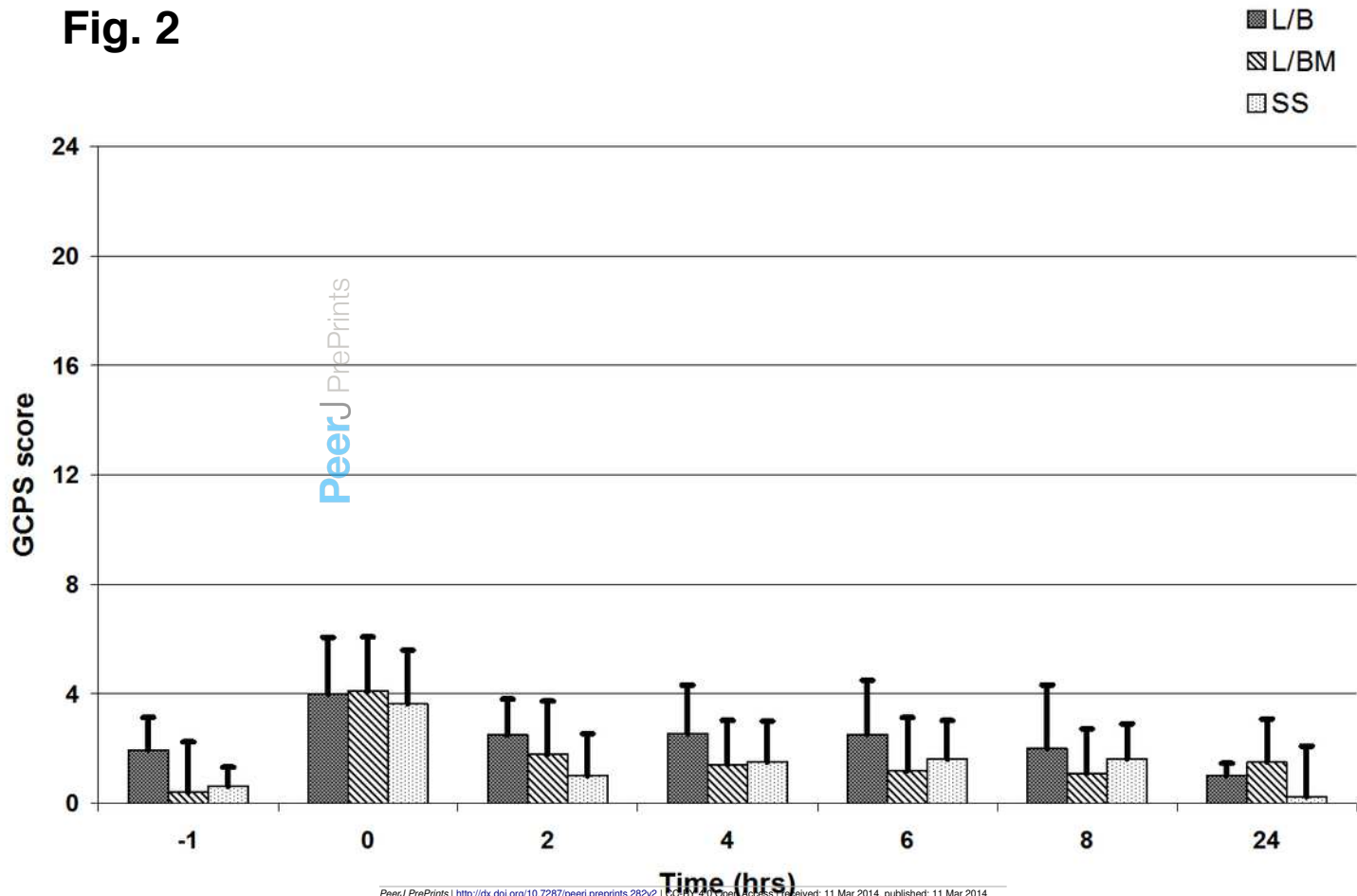
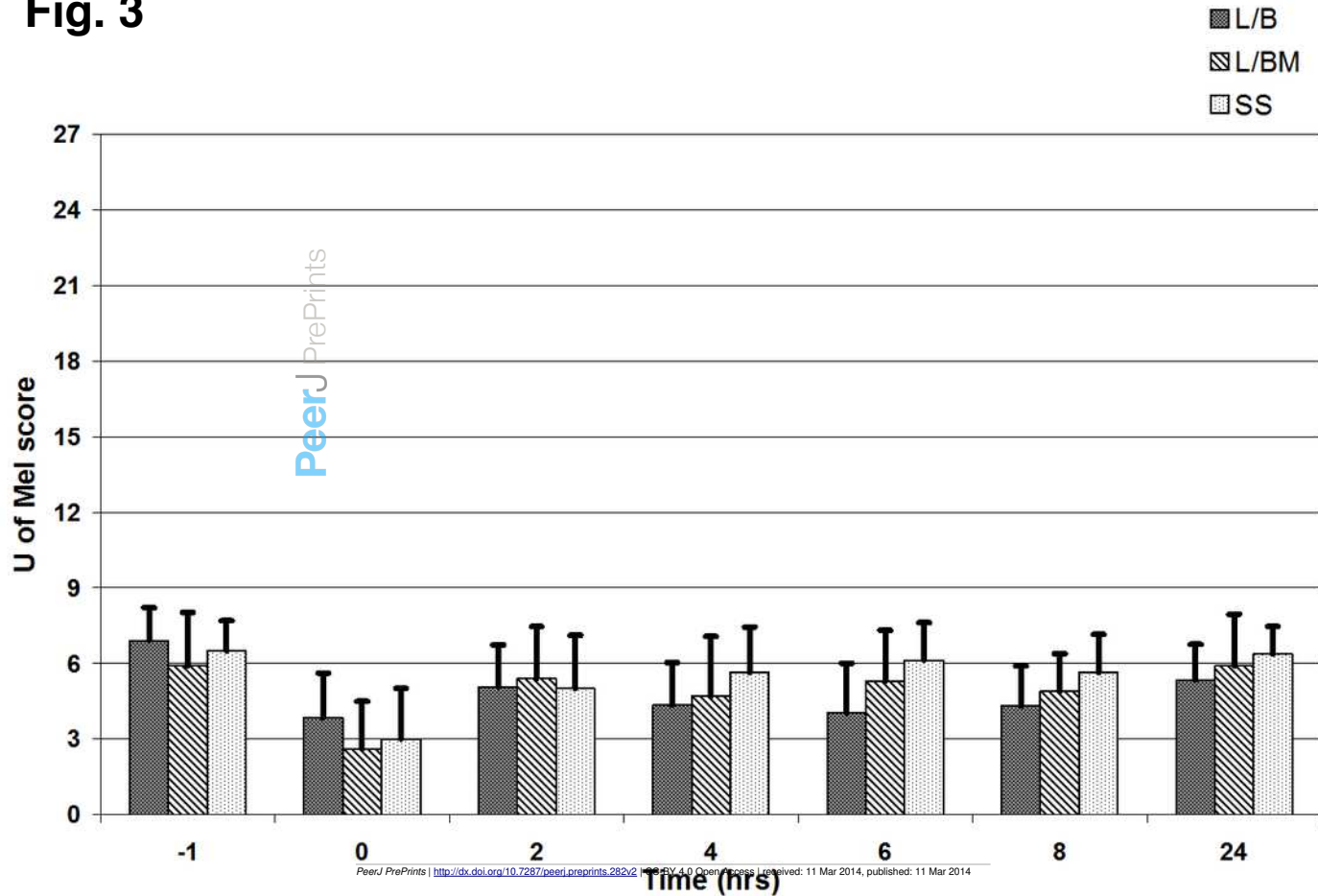
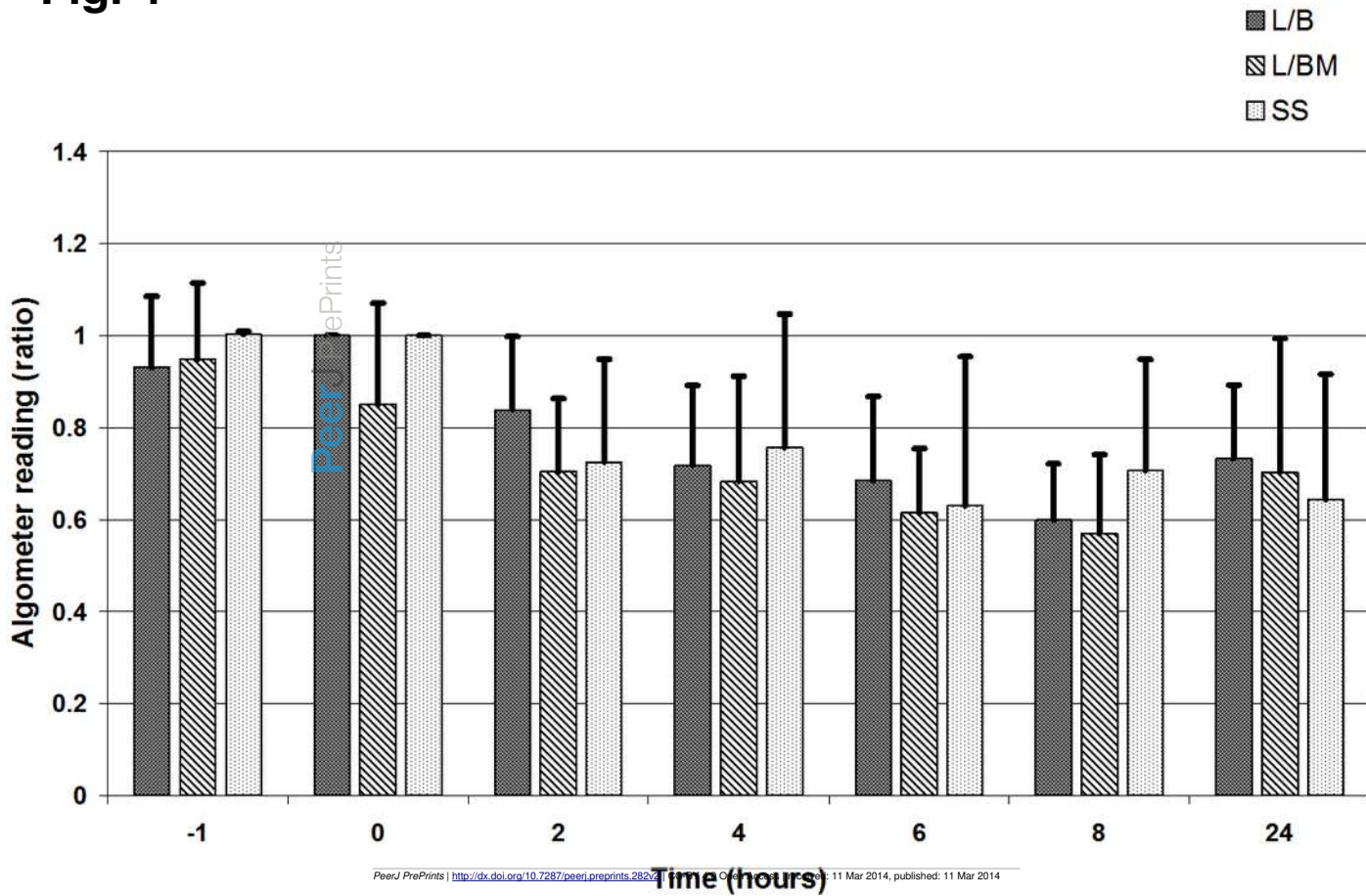


Fig. 3



# Fig. 4



# Fig. 5

