



Analysis of Perioperative Blood Transfusion Necessity

Among Various Types of Surgery in Dogs

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Introduction

As challenging major surgeries are increasingly performed by veterinarians, the necessity for perioperative blood transfusions can be expected. Based on clinical impression, some surgery patients may be more likely than others to hemorrhage significantly enough to require whole blood, packed red blood cell, or oxyglobin transfusion. A blood transfusion is generally warranted when the dog's packed cell volume (PCV) falls below 20%, because at this point cardiac and pulmonary function is impaired. Within the abdominal cavity, surgeries at particular risk for hemorrhage include gastrectomy, liver lobectomy, and splenectomy, among others. Because of the vascular anatomy within the thoracic cavity, intra-thoracic surgery patients might be expected to be at risk for life-threatening hemorrhage. Additionally, there are some extra-abdominal/extra-thoracic surgeries known for hemorrhagic tendencies, such as neoplastic thyroidectomy, rhinotomy, and, in some instances, perineal hernia.

Hypotheses

- Among the three categories of surgery, there will be no difference in transfusion requirement.
- There will be no difference in transfusion requirement among gastrectomy, liver lobectomy, splenectomy, neoplastic thyroidectomy, rhinotomy, and perineal hernia.

Methods

- Dogs that underwent surgical procedures at the University of Missouri Veterinary Medical Teaching Hospital from 2004 to 2013
- A complete surgical report and medical record was required for inclusion in the study
- Dogs were placed into one of three groups based on the site of their surgery: abdominal, thoracic, or extra-abdominal/extra-thoracic
- Specific abdominal surgeries were gastrectomy, liver lobectomy, and splenectomy
- Specific extra-abdominal/extra-thoracic surgeries were neoplastic thyroidectomy, rhinotomy, and perineal hernia
- There was no breakdown of intra-thoracic surgery cases into specific surgeries
- Variables recorded were the type of surgery and whether a whole blood, packed red blood cell, or oxyglobin transfusion was required preoperatively, intraoperatively or within 24 hours postoperatively (yes/no)
- For all cases, whether or not transfusion was performed, packed cell volume and total protein was recorded

Results*

Liver Lobectomy (n=20)		Splenectomy (n=82)		Thyroidectomy (n=14)		Rhinotomy (n=17)		Perineal Hernia (n=23)		Thoracotomy (n=45)	
# transfusion	9	# transfusion	33	# transfusion	0	# transfusion	0	# transfusion	2	# transfusion	6
# no transfusion	11	# no transfusion	49	# no transfusion	14	# no transfusion	17	# no transfusion	21	# no transfusion	39
PCV before surgery		PCV before surgery		PCV before surgery		PCV before surgery		PCV before surgery		PCV before surgery	
mean overall (n=20)	38.2 (14-52)	mean overall (n=81)	34.1 (16-59)	mean overall (n=11)	45.8 (35-52)	mean overall (n=17)	47.6 (33-55)	mean overall (n=22)	47	mean overall (n=41)	44.5 (25-62)
mean transfusion (n=9)	33.7 (14-48)	mean transfusion (n=33)	26.8 (16-56)	mean transfusion (n=0)	n/a	mean transfusion (n=0)	n/a	mean transfusion (n=2)	48.5 (46-51)	mean transfusion (n=6)	31.8 (25-41)
mean no transfusion (n=11)	41.9 (27-52)	mean no transfusion (n=48)	39.1 (25-59)	mean no transfusion (n=11)	45.8 (35-52)	mean no transfusion (n=17)	47.6 (33-55)	mean no transfusion (n=20)	46.9 (37-56)	mean no transfusion (n=35)	46.6 (31-62)
PCV after surgery		PCV after surgery		PCV after surgery		PCV after surgery		PCV after surgery		PCV after surgery	
mean overall (n=19)	32.7 (11-51)	mean overall (n=63)	29 (8-51)	mean overall (n=5)	40.6 (38-45)	mean overall (n=11)	36.6 (29-47)	mean overall (n=5)	43 (38-47)	mean overall (n=22)	37 (25-55)
mean transfusion (n=8)	25.1 (11-37)	mean transfusion (n=31)	24.7 (8-40)	mean transfusion (n=0)	n/a	mean transfusion (n=0)	n/a	mean transfusion (n=2)	43 (40-46)	mean transfusion (n=5)	32.6 (25-44)
mean no transfusion (n=11)	38.3 (23-51)	mean no transfusion (n=32)	34.1 (23-51)	mean no transfusion (n=5)	40.6 (38-45)	mean no transfusion (n=11)	36.6 (29-47)	mean no transfusion (n=3)	43 (38-47)	mean no transfusion (n=17)	38.4 (27-55)
TP before transfusion		TP before transfusion		TP before transfusion		TP before transfusion		TP before transfusion		TP before transfusion	
mean transfusion (n=9)	20.6 (11-34)	mean transfusion (n=38)	24.7 (8-39)	mean transfusion (n=0)	n/a	mean transfusion (n=0)	n/a	mean transfusion (n=2)	30.5 (10-51)	mean transfusion (n=9)	22.4 (12-35)
TP after transfusion		TP after transfusion		TP after transfusion		TP after transfusion		TP after transfusion		TP after transfusion	
mean transfusion (n=10)	30.7 (16-50)	mean transfusion (n=34)	29.9 (13-40)	mean transfusion (n=0)	n/a	mean transfusion (n=0)	n/a	mean transfusion (n=2)	33.5 (27-40)	mean transfusion (n=7)	25.7 (17-32)
TP before surgery		TP before surgery		TP before surgery		TP before surgery		TP before surgery		TP before surgery	
mean overall (n=20)	6.5 (3-9.9)	mean overall (n=79)	6.5 (3-9.4)	mean overall (n=12)	7 (5.7-8.3)	mean overall (n=16)	7.1 (6.1-8.4)	mean overall (n=22)	7 (5.4-8.5)	mean overall (n=41)	6.3 (3.2-7.9)
mean transfusion (n=9)	6.5 (3-9.9)	mean transfusion (n=32)	6.1 (3-8.6)	mean transfusion (n=0)	n/a	mean transfusion (n=0)	n/a	mean transfusion (n=2)	7.7 (7.3-8.1)	mean transfusion (n=6)	4.9 (3.2-7.1)
mean no transfusion (n=11)	6.6 (5.4-7.7)	mean no transfusion (n=47)	6.9 (4.8-9.4)	mean no transfusion (n=12)	7 (5.7-8.3)	mean no transfusion (n=16)	7.1 (6.1-8.4)	mean no transfusion (n=20)	6.9 (5.4-8.5)	mean no transfusion (n=35)	6.6 (4.2-7.9)
TP after surgery		TP after surgery		TP after surgery		TP after surgery		TP after surgery		TP after surgery	
mean overall (n=19)	4.7 (3-7.6)	mean overall (n=64)	4.9 (2.9-6.6)	mean overall (n=5)	6.1 (5.2-6.8)	mean overall (n=11)	5.3 (3-6.4)	mean overall (n=5)	5.8 (4.8-6.5)	mean overall (n=22)	4.7 (2.5-6.6)
mean transfusion (n=8)	3.9 (3-6.1)	mean transfusion (n=31)	4.4 (2.9-6.5)	mean transfusion (n=0)	n/a	mean transfusion (n=0)	n/a	mean transfusion (n=2)	5 (4.8-5.2)	mean transfusion (n=5)	3.9 (2.5-6.6)
mean no transfusion (n=11)	5.2 (3-7.6)	mean no transfusion (n=33)	5.4 (4-6.5)	mean no transfusion (n=5)	6.1 (5.2-6.8)	mean no transfusion (n=11)	5.3 (3-6.4)	mean no transfusion (n=3)	6.3 (5.9-6.5)	mean no transfusion (n=17)	5 (3.8-6.3)
TP before transfusion		TP before transfusion		TP before transfusion		TP before transfusion		TP before transfusion		TP before transfusion	
mean transfusion (n=9)	3.8 (2-6.1)	mean transfusion (n=31)	5 (2.9-8.6)	mean transfusion (n=0)	n/a	mean transfusion (n=0)	n/a	mean transfusion (n=2)	5.6 (3-8.1)	mean transfusion (n=5)	3.4 (3-3.8)
TP after transfusion		TP after transfusion		TP after transfusion		TP after transfusion		TP after transfusion		TP after transfusion	
mean transfusion (n=10)	3.7 (2-6)	mean transfusion (n=32)	4.7 (3.2-6.7)	mean transfusion (n=0)	n/a	mean transfusion (n=0)	n/a	mean transfusion (n=2)	3.9 (2.8-5)	mean transfusion (n=8)	3.5 (3-4)
Survivors (n=15)		Survivors (n=71)		Survivors (n=14)		Survivors (n=17)		Survivors (n=21)		Survivors (n=33)	
# transfusion	6	# transfusion	24	# transfusion	0	# transfusion	0	# transfusion	1	# transfusion	1
# no transfusion	9	# no transfusion	47	# no transfusion	14	# no transfusion	17	# no transfusion	20	# no transfusion	32
PCV transfusion before surgery (n=6)	29.8 (14-42)	PCV transfusion before surgery (n=24)	28.1 (17-56)	PCV transfusion before surgery (n=0)	n/a	PCV transfusion before surgery (n=0)	n/a	PCV transfusion before surgery (n=1)	51	PCV transfusion before surgery (n=1)	29
PCV no transfusion before surgery (n=9)	42.7 (27-52)	PCV no transfusion before surgery (n=46)	39.2 (25-59)	PCV no transfusion before surgery (n=11)	45.8 (35-52)	PCV no transfusion before surgery (n=17)	47.6 (33-55)	PCV no transfusion before surgery (n=19)	47.4 (42-56)	PCV no transfusion before surgery (n=28)	46 (31-62)
PCV transfusion after surgery (n=6)	27.5 (19-37)	PCV transfusion after surgery (n=23)	25.9 (13-40)	PCV transfusion after surgery (n=0)	n/a	PCV transfusion after surgery (n=0)	n/a	PCV transfusion after surgery (n=1)	46	PCV transfusion after surgery (n=1)	25
PCV no transfusion after surgery (n=9)	39.9 (27-51)	PCV no transfusion after surgery (n=31)	34.4 (25-51)	PCV no transfusion after surgery (n=5)	40.6 (38-45)	PCV no transfusion after surgery (n=11)	36.6 (29-47)	PCV no transfusion after surgery (n=3)	43 (38-47)	PCV no transfusion after surgery (n=14)	38.8 (27-55)
TP transfusion before surgery (n=6)	5.8 (3-7.3)	TP transfusion before surgery (n=23)	6.2 (4.2-8.6)	TP transfusion before surgery	n/a	TP transfusion before surgery	n/a	TP transfusion before surgery (n=1)	8.1	TP transfusion before surgery (n=1)	3.7
TP no transfusion before surgery (n=9)	6.8 (5.8-7.7)	TP no transfusion before surgery (n=45)	6.9 (4.8-9.4)	TP no transfusion before surgery	7 (5.7-8.3)	TP no transfusion before surgery	7.1 (6.1-8.4)	TP no transfusion before surgery (n=19)	7 (5.4-8.5)	TP no transfusion before surgery (n=28)	6.7 (4.6-7.9)
TP transfusion after surgery (n=6)	4 (3-6.1)	TP transfusion after surgery (n=22)	4.6 (2.9-6.5)	TP transfusion after surgery	n/a	TP transfusion after surgery	n/a	TP transfusion after surgery (n=1)	6.4	TP transfusion after surgery (n=1)	3.1
TP no transfusion after surgery (n=9)	5.6 (3.1-7.6)	TP no transfusion after surgery (n=31)	5.4 (4-6.6)	TP no transfusion after surgery	6.1 (5.2-6.8)	TP no transfusion after surgery	5.3 (3-6.4)	TP no transfusion after surgery (n=3)	6.3 (5.9-6.5)	TP no transfusion after surgery (n=14)	5.2 (4.1-6.3)
Nonsurvivors (n=4)		Nonsurvivors (n=11)		Nonsurvivors (n=0)		Nonsurvivors (n=0)		Nonsurvivors (n=2)		Nonsurvivors (n=12)	
# transfusion	2	# transfusion	9	# transfusion	n/a	# transfusion	n/a	# transfusion	1	# transfusion	5
# no transfusion	2	# no transfusion	2	# no transfusion	n/a	# no transfusion	n/a	# no transfusion	1	# no transfusion	7
PCV transfusion before surgery (n=2)	38 (29-47)	PCV transfusion before surgery (n=9)	23.2 (16-36)	PCV transfusion before surgery (n=2)	n/a	PCV transfusion before surgery (n=2)	n/a	PCV transfusion before surgery (n=1)	46	PCV transfusion before surgery (n=5)	32.4 (25-41)
PCV no transfusion before surgery (n=2)	38.5 (32-45)	PCV no transfusion before surgery (n=2)	39 (32-46)	PCV no transfusion before surgery (n=2)	n/a	PCV no transfusion before surgery (n=2)	n/a	PCV no transfusion before surgery (n=2)	37	PCV no transfusion before surgery (n=7)	49 (37-59)
PCV transfusion after surgery (n=2)	18 (11-25)	PCV transfusion after surgery (n=8)	21.1 (8-27)	PCV transfusion after surgery (n=2)	n/a	PCV transfusion after surgery (n=2)	n/a	PCV transfusion after surgery (n=1)	40	PCV transfusion after surgery (n=4)	34.5 (25-44)
PCV no transfusion after surgery (n=2)	31 (23-39)	PCV no transfusion after surgery (n=1)	23	PCV no transfusion after surgery (n=2)	n/a	PCV no transfusion after surgery (n=2)	n/a	PCV no transfusion after surgery (n=0)	n/a	PCV no transfusion after surgery (n=3)	36.3 (30-44)
TP transfusion before surgery (n=2)	8.9 (7.6-9.9)	TP transfusion before surgery (n=8)	5.8 (3-8.2)	TP transfusion before surgery (n=2)	n/a	TP transfusion before surgery (n=2)	n/a	TP transfusion before surgery (n=1)	7.3	TP transfusion before surgery (n=5)	5.1 (3.2-7.1)
TP no transfusion before surgery (n=2)	5.5 (5.4-5.5)	TP no transfusion before surgery (n=2)	5.9 (5.6-6.3)	TP no transfusion before surgery (n=2)	n/a	TP no transfusion before surgery (n=2)	n/a	TP no transfusion before surgery (n=1)	7	TP no transfusion before surgery (n=7)	6.4 (4.2-7.3)
TP transfusion after surgery (n=2)	3.7 (3-4.4)	TP transfusion after surgery (n=8)	4.5 (3.3-6.1)	TP transfusion after surgery (n=2)	n/a	TP transfusion after surgery (n=2)	n/a	TP transfusion after surgery (n=1)	5.2	TP transfusion after surgery (n=4)	4.1 (2.5-6.6)
TP no transfusion after surgery (n=2)	3.5 (3-4)	TP no transfusion after surgery (n=1)	4	TP no transfusion after surgery (n=2)	n/a	TP no transfusion after surgery (n=2)	n/a	TP no transfusion after surgery (n=0)	n/a	TP no transfusion after surgery (n=3)	3.9 (3.8-4.2)
Age (years)		Age (years)		Age (years)		Age (years)		Age (years)		Age (years)	
mean overall (n=20)	9.9	mean overall (n=81)	9.6 (1-14)	mean overall (n=14)	9.6 (3-15)	mean overall (n=17)	7.5 (2-14)	mean overall (n=23)	8.8 (4-17)	mean overall (n=45)	7.7 (0.5-14)
mean transfusion (n=9)	11.6 (8-16)	mean transfusion (n=32)	9.3 (3-14)	mean transfusion (n=0)	n/a	mean transfusion (n=0)	n/a	mean transfusion (n=2)	8.5 (8-9)	mean transfusion (n=6)	9.5 (1-13)
mean no transfusion (n=11)	8.5 (3-12)	mean no transfusion (n=49)	9.8 (1-14)	mean no transfusion (n=14)	9.6 (3-15)	mean no transfusion (n=17)	7.5 (2-14)	mean no transfusion (n=21)	8.8 (4-17)	mean no transfusion (n=39)	7.5 (0.5-14)
mean survivor (n=15)	9 (3-12)	mean survivor (n=71)	9.8 (1-14)	mean survivor (n=14)	9.6 (3-15)	mean survivor (n=17)	7.5 (2-14)	mean survivor (n=15)	9 (5-17)	mean survivor (n=33)	7.8 (1-14)
mean nonsurvivor (n=4)	12.5 (7-16)	mean nonsurvivor (n=10)	8.3 (3-13)	mean nonsurvivor (n=0)	n/a	mean nonsurvivor (n=0)	n/a	mean nonsurvivor (n=2)	6 (4-8)	mean nonsurvivor (n=12)	7.7 (0.5-13)
Large Breeds (>20kg) (n=14)		Large Breeds (>20kg) (n=60)		Large Breeds (>20kg) (n=10)		Large Breeds (>20kg) (n=12)		Large Breeds (>20kg) (n=7)		Large Breeds (>20kg) (n=14)	
# transfusion	6	# transfusion	28	# transfusion	0	# transfusion	0	# transfusion	0	# transfusion	6
# no transfusion	2	# no transfusion	32	# no transfusion	10	# no transfusion	12	# no transfusion	7	# no transfusion	23
Small Breeds (<20kg) (n=6)		Small Breeds (<20kg) (n=22)		Small Breeds (<20kg) (n=4)		Small Breeds (<20kg) (n=5)		Small Breeds (<20kg) (n=16)		Small Breeds (<20kg) (n=6)	
# transfusion	3	# transfusion	5	# transfusion	0	# transfusion	0	# transfusion	2	# transfusion	10
# no transfusion	3	# no transfusion	17	# no transfusion	4	# no transfusion	5	# no transfusion	14	# no transfusion	6

*PCV recorded in % and TP recorded in g/dL.

Conclusions

Surgeries within the abdominal cavity required more transfusions than intra-thoracic cavity and extra-abdominal/extra-thoracic surgeries. The clinical significance is that blood products should be available for surgeries planned within this category in case of hemorrhage. For intra-thoracic and intra-abdominal surgeries, the recorded PCV both before and after surgery was lower for cases requiring a transfusion than for those that did not. However, within the extra-abdominal and extra-thoracic surgery category, two of the surgeries (rhinotomy and thyroidectomy) did not require any transfusions. Therefore, extra-body cavity surgeries are less likely to necessitate blood products perioperatively. The perineal hernia data collected showed that even though transfusions are uncommon for these types of surgeries, the possibility exists and blood products should be considered. Further statistical analysis will be necessary to accept or reject our hypotheses.