

What You Know that Ain't Necessarily So

An Evidence-based Approach to Common Beliefs &
Practices in Veterinary Medicine

Tradition

Evidence

Facts

Journals

Colleagues

Knowledge

Research

Textbooks **Teachers**

Experience

Bias

The greatest enemy of knowledge is not ignorance, it is the illusion of knowledge.

Daniel J. Boorstin

The only true wisdom is in knowing you know nothing.

Socrates

Real knowledge is to know the extent of one's ignorance.

Confucius

To know that we know what we know, and to know that we do not know what we do not know, that is true knowledge.

Nicolaus Copernicus

To be conscious that you are ignorant is a great step to knowledge.

Benjamin Disraeli

To know that you do not know is the best.

To think you know when you do not is a disease.

Recognizing this disease as a disease is to be free of it.

Lao Tzu

Perplexity is the beginning of knowledge

Khalil Gibran

Evidence-based Medicine

The integration of the best research evidence with our clinical expertise and our patient's unique values and circumstances.

Straus, S.E. 2005

Evidence-based Medicine

The real purpose of the scientific method is to make sure Nature hasn't misled you into thinking you know something you actually don't know.

Robert Pirsig
Zen and the Art of Motorcycle Maintenance

Uncertainty

Uncertainty is an uncomfortable position. But certainty is an absurd one.

— Voltaire

Hierarchy of Evidence

Systematic reviews, EBM guidelines, CATs

Synthetic Literature

RCTs, other designs, case reports, pre-clinical, human studies

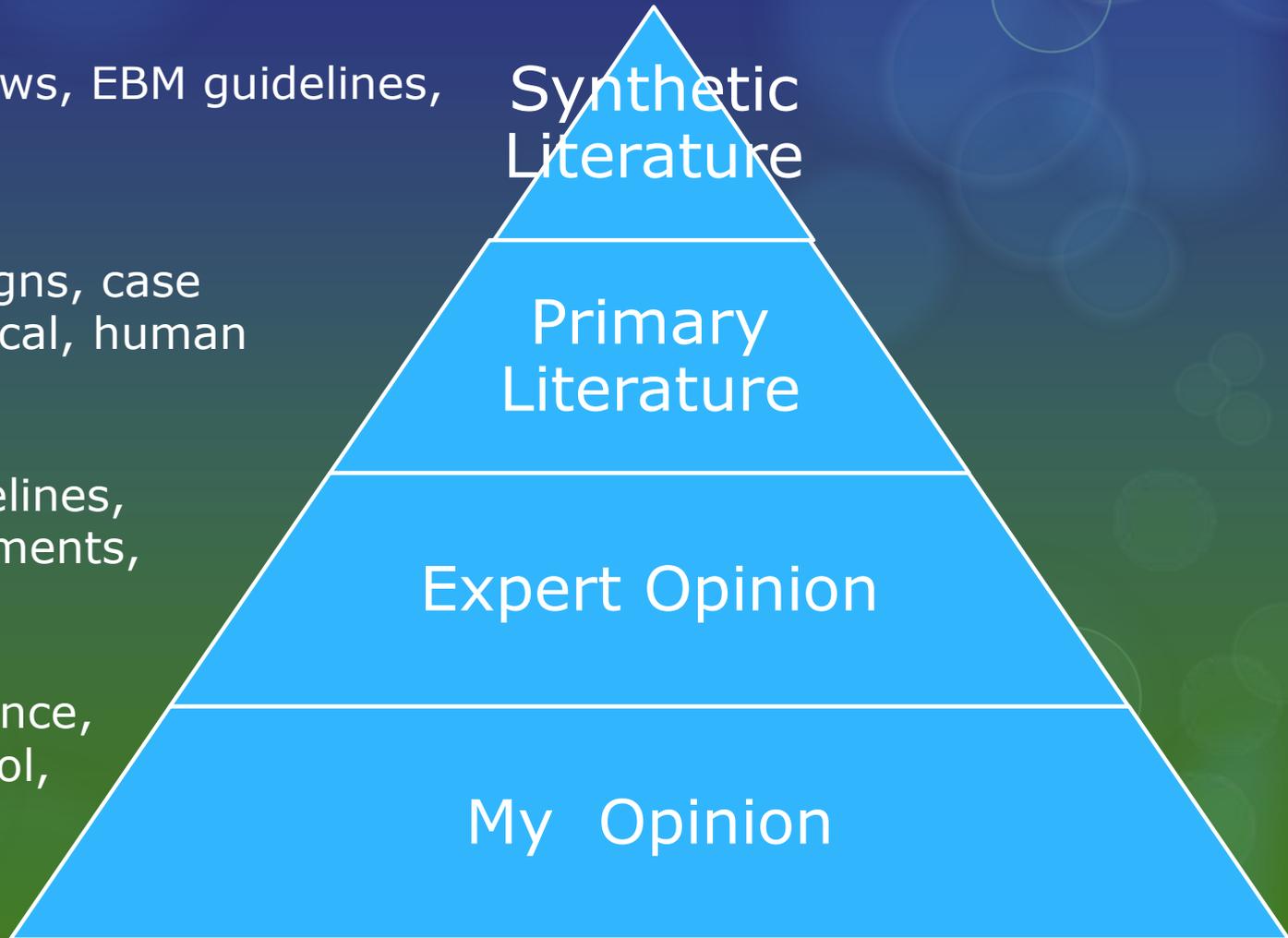
Primary Literature

CE, clinical guidelines, consensus statements, textbooks

Expert Opinion

personal experience, colleagues, school, CE, ????????????

My Opinion



Glucosamine

P- patient, problem

I- intervention

C- comparator

O- Outcome

Glucosamine

P- Dogs with naturally occurring arthritis

I- oral glucosamine

C- NSAID, nothing

O- Reduced pain, lameness

Glucosamine

Synthetic Vet Literature- Systematic Reviews

the global strength of evidence of efficacy was low...In addition, results were contradictory in the 2 studies conducted in dogs

Vandeweerd, J.M. (2012)

Low quality & quantity of evidence, no overall recommendation

Sanderson, R.O. (2009)

1 study included, good quality, no benefit

Aragon, C.L. (2007)

Glucosamine

Synthetic Vet Literature- CATs

- Best Bets for Vets

Nutraceuticals versus carprofen in dogs with osteoarthritis

Carprofen is superior to glucosamine/chondroitin supplements in reducing the clinical signs of osteoarthritis (McCarthy et al. 2007). Glucosamine and chondroitin supplement efficacy cannot be commented on, as there was no placebo group or there was no comparison made with the placebo group in the studies.

Glucosamine

Synthetic Vet Literature- CATs

- **Banfield**

Evaluation of glucosamine hydrochloride/ chondroitin sulfate nutraceuticals as a treatment to improve symptoms associated with canine and feline joint disease

Despite some evidence that a combination of glucosamine hydrochloride and chondroitin sulfate nutraceuticals improves symptoms associated with joint disease in dogs and cats, strong clinical evidence of efficacy is lacking, and these compounds are understudied.

Glucosamine

Synthetic Vet Literature- CATs

- McKenzie, BA (2010)

2 studies, mixed results, better quality study found no benefit, carprofen better

Glucosamine

Primary Vet Literature-

Already evaluated in the synthetic literature

Glucosamine

Human Literature- Systematic Reviews

Dozens of systematic reviews in PubMed

[Glucosamine] is ineffective for pain reduction in patients with knee OA. GS may have function-modifying effects in patients with knee OA when administered for more than 6 months. However, it showed no pain-reduction benefits after 6 months of therapy.

Wu, D. (2013)

Glucosamine

Human Literature- Systematic Reviews

Significant improvement in pain and functional indices and a decrease in the loss of joint space width were demonstrated in some but not all studies...The safety of these nutraceuticals has been demonstrated across all of the reviewed trials, and there were no significant issues with tolerance...An overall recommendation to use nutraceuticals in the treatment of all patients with OA is not strongly supported by the available data.

Ragle, R.L. (2012)

Glucosamine

Human Literature- Systematic Reviews

Compared with placebo, glucosamine, chondroitin, and their combination do not reduce joint pain or have an impact on narrowing of joint space. Health authorities and health insurers should not cover the costs of these preparations, and new prescriptions to patients who have not received treatment should be discouraged.

Wandel, S. (2010)

Glucosamine

Human Literature- Systematic Reviews

Pooled results from studies using a non-Rotta preparation or adequate allocation concealment failed to show benefit in pain and WOMAC function while those studies evaluating the Rotta preparation showed that glucosamine was superior to placebo in the treatment of pain and functional impairment resulting from symptomatic OA.

Towheed, T. (2005)

Glucosamine

Human Literature- Systematic Reviews

Most of the observed heterogeneity in glucosamine trials is explained by brand...Large inconsistency was found though. Low risk of bias trials, using the Rottapharm|Madaus product, revealed a small effect size.

Eriksen, P. (2014)

Glucosamine

Human Literature- Guidelines

We cannot recommend using glucosamine and chondroitin for patients with symptomatic osteoarthritis of the knee.... At this time, both glucosamine and chondroitin sulfate have been extensively studied. Despite the availability of the literature, there is essentially no evidence that minimum clinically important outcomes have been achieved compared to placebo, whether evaluated alone or in combination.

American Academy of Orthopedic Surgeons

Glucosamine

Human Literature- Guidelines

We conditionally recommend that patients with OA should not use the following:

*Chondroitin sulfate
Glucosamine*

American College of Rheumatology

Glucosamine

Human Literature- Guidelines

Glucosamine and chondroitin were both found to be "not appropriate" for all patients when used for disease modification and "uncertain" for all patients when used for symptom relief.

Osteoarthritis Research Society International

Glucosamine

Human Literature- Primary

Glucosamine/Chondroitin Arthritis Intervention trial (GAIT)

- *Over 2 years, no treatment achieved a clinically important difference in WOMAC pain or function as compared with placebo.... Glucosamine and chondroitin sulfate alone or in combination did not reduce pain effectively in the overall group of patients with osteoarthritis of the knee. Exploratory analyses suggest that the combination of glucosamine and chondroitin sulfate may be effective in the subgroup of patients with moderate-to-severe knee pain.*
- *At 2 years, no treatment achieved a predefined threshold of clinically important difference in JSW loss as compared with placebo.*

Glucosamine

Bottom Line-

- Almost certainly safe
- Basic science supports potential benefits
- Very limited research in dogs
 - Weak and conflicting evidence
 - Little reason to believe significant benefits
- Extensive human research
 - Conflicting evidence
 - Most likely little to no benefit

Glucosamine

Bottom Line-

- Employ more strongly supported therapies first
 - NSAIDs
- Client preference

Neutering & Mammary Neoplasia

P- female dogs

I- neutering (timing)

C- remaining intact (timing)

O- incidence/mortality mammary neoplasia

Neutering & Mammary Neoplasia

Risk

- 0.5% if spayed before first heat
- 8% if spayed before second heat
- 26% if spayed after second heat

Schneider, R. (1969)

Neutering & Mammary Neoplasia

Risk-intact females

- 53.3% (varies by breed and age: 4-35/1,000/yr)

Moe, L. (2001)

- 1% 6yrs, 6% 8yrs, 13% 10yrs
- 111/10,000 DYAR (5-319/10,000 DYAR)

Egenvall, A. (2002)

- 205 tumors/100,000 dogs/year SI

Dobson, J.M. (2002)

Neutering & Mammary Neoplasia

Synthetic Vet Literature- Systematic Reviews

- 13 peer-reviewed journal articles in English
- 9 high risk of bias
- 4 moderate risk of bias
 - 1 found protective association
 - 2 found no association
 - 1 “some protective effect” but no numbers

Beauvais, W. (2012)

Neutering & Mammary Neoplasia

Synthetic Vet Literature- CATs

- Best Bets for Vets

Age at neutering and mammary tumours in bitches

*Spaying bitches before the first or second season, or before the age of 2.5 years, **may** be associated with a reduced risk of developing malignant mammary tumours later in life...However, **the evidence is relatively weak**, and this should be taken into account alongside other considerations when recommending whether and when to neuter.*

Neutering & Mammary Neoplasia

Primary Vet Literature-

- Strong protective effect
- No confidence interval or p-value
- Matched cases/controls, matched analysis?
- Cases/controls from different time periods
- Only for cases with histopathology
- Previous hormone use?

Schneider, R. (1969)

Neutering & Mammary Neoplasia

Primary Vet Literature-

- “inconsistent although some protective effect”
- No quantitative assessment
- No control for age, previous hormone use
- Research Beagles
- Neutered at 10-12 years of age
- Primary purpose to evaluate Rad Tx

Bruenger, F.W. (1994)

Neutering & Mammary Neoplasia

Primary Vet Literature-

- No association (neutering & any type of mammary mass)
- Age at neutering not reported
- No control for age, breed, previous hormone use
- Only for cases with histopathology
- Primary purpose diet and mammary tumors

Pérez Alenza, D. (1998)

Neutering & Mammary Neoplasia

Primary Vet Literature-

- No association (neutering & proportion of submitted tumor samples neoplastic)
- Age and age at neutering not reported
- No control for age, previous hormone use
- Only for cases with histopathology
- No CI

Richards, H.G. (2001)

Neutering & Mammary Neoplasia

Primary Vet Literature-

- No association between age at neutering and neoplasia
- All neutered 6 weeks-12 months
- Mammary neoplasia not specifically addressed
- Shelter dogs
- Underpowered for uncommon outcomes

Spain, C.V. (2004)

Neutering & Mammary Neoplasia

Human Literature- Primary

- > 66,000 women studied, observational

The risk for breast cancer was reduced by 27% among women who had hysterectomy and BSO before 45 years of age, and by 20% among those who had simple hysterectomy before age 45 years.

Gaudet, M.M. (2014)

Neutering & Mammary Neoplasia

Human Literature- Primary

- ~4,500 women studied, case/control

Bilateral ovariectomy was associated with reduced breast cancer risk overall (odds ratio (OR) = 0.59, 95% confidence interval (CI): 0.50, 0.69) and among women <45 years of age (ORs ranged from 0.31 to 0.52), but not among those who were older at surgery.

Press, D.J. (2011)

Neutering & Mammary Neoplasia

Bottom Line-

- Available evidence suggests neutering reduces mammary cancer risk
- Earlier neutering may be more protective
- Great variation with breed, age, other factors
- Existing evidence is very weak
- Strong or numeric claims not justified

ACE-I & MVD without CHF

VIN Poll 2007

When do you believe that ACEIs should be started when treating a dogs with MVD but not in CHF?

1 (4%): A. Never

0 (0%): B. As soon as a murmur of MR is first detected.

2 (9%): C. When the murmur of MR become louder than a grade 2.

8 (35%): D. Evidence of moderate LA or LV enlargement.

1 (4%): E. Evidence of severe LA or LV enlargement

11 (48%): F. When the dog develops CHF (pulmonary edema)

ACE-I & MVD without CHF

P- dogs with naturally occurring MVD

I- ACE-I before onset of CHF

C- no ACE-I before onset CHF

O- time to CHF, survival

ACE-I & MVD without CHF

Synthetic Vet Literature- Systematic Reviews

None

ACE-I & MVD without CHF

Synthetic Vet Literature- CATS

- Best Bets for Vets

Benazepril in dogs with asymptomatic mitral valve disease
(1 study, significant weaknesses)

There is insufficient evidence to suggest that dogs with asymptomatic mitral valve disease treated with benazepril will live longer.

ACE-I & MVD without CHF

Primary Vet Literature-

Long-term treatment with enalapril in asymptomatic dogs with MVD and MR did not delay the onset of heart failure regardless of whether or not cardiomegaly was present at initiation of the study.

Kvart, C. (2002) SVEP: Scandinavian Veterinary Enalapril Prevention Trial)

ACE-I & MVD without CHF

Primary Vet Literature-

Chronic enalapril treatment of dogs with naturally occurring, moderate to severe MR significantly delayed onset of CHF...Improvement in the primary endpoint, CHF-free survival, was not significant. Results suggest that enalapril modestly delays the onset of CHF in dogs with moderate to severe MR.

Atkins, C.E. (2007) VETPROOF

ACE-I & MVD without CHF

Primary Vet Literature-

Atkins, C.E. (2007) VETPROOF

- No difference in primary endpoint (time to CHF)
- Questionable secondary endpoint (all-cause mortality)
- Selective exclusion of some subjects from analysis
- Selection of time points for comparison

ACE-I & MVD without CHF

Primary Vet Literature-

BNZ had beneficial effects in asymptomatic dogs other than CKC and KC affected by MVD with moderate-to-severe MR.

Pouchelon, J.L. (2008)

ACE-I & MVD without CHF

Primary Vet Literature-

Pouchelon, J.L. (2008)

- No difference overall in development of CHF or “cardiac events”
- Questionable endpoints (all-cause mortality)
- Differences between groups in disease severity

ACE-I & MVD without CHF

Human Literature- Systematic Reviews

ACE inhibitors...reduced the RF, RV, and left ventricular size by a modest degree in chronic primary MR...and may offer a pharmacologic treatment option to delay the deleterious hemodynamic effects of left ventricular volume overload.

Strauss, C.E. (2012)

ACE-I & MVD without CHF

Human Literature- Guidelines

- *In the asymptomatic patient with chronic MR, there is no generally accepted medical therapy.*
- *There has not been a consistent improvement in LV volumes and severity of MR in the small studies that have examined the effect of ACE inhibitors.*
- *in the absence of systemic hypertension, there is no known indication for the use of...ACE inhibitors in asymptomatic patients with MR and preserved LV function.*

ACE-I & MVD without CHF

Human Literature- Guidelines

- *If LV systolic dysfunction is present, primary treatment of the LV systolic dysfunction with drugs such as ACE...[has] been shown to reduce the severity of functional MR*

American College of Cardiology/American Heart Association (2006)

ACE-I & MVD without CHF

Bottom Line-

- Research is conflicting
- Cardiologists disagree
- *Critical review of the evidence* does not suggest ACE-I
 - Delay onset of CHF
 - Prolong survival when begun before CHF

Evaluation of Evidence

- PICO question
- Veterinary Synthetic Literature
 - Systematic Reviews
 - CATs
 - Guidelines
- Veterinary Primary Literature
- Human Literature
 - Systematic Reviews
 - Guidelines
- Bottom Line

Pre-anesthetic Bloodwork

P- healthy dogs & cats

I- routine cbc/chem before anesthesia

C- no bloodwork

Q- mortality, complications, change plan

Pre-anesthetic Bloodwork

Synthetic Vet Literature- Systematic Reviews

None

Synthetic Vet Literature- CATs

None

Synthetic Vet Literature- Guidelines

None (ACVAA, AVA, AAHA, VASG)

Pre-anesthetic Bloodwork

Primary Vet Literature-

- cbc/biochemistry profiles for 1537 dogs
- university surgery population
- variety of ASA stages
- No indication in PE/Hx for labwork in 84%

Alef, M. (2008)

Pre-anesthetic Bloodwork

Primary Vet Literature-

- Recategorized in ASA level- 8%
- Procedure postponed- 0.8%
- Additional therapy- 1.5%
- Change in protocol- 0.2%

Alef, M. (2008)

Pre-anesthetic Bloodwork

Primary Vet Literature-

- Complications in 1.9% of patients
 - Lab values normal or unrelated in 84% of these
 - 3.8% incidence with lab abnormalities
 - 1.8% incidence with normal labs (no statistical difference)

Alef, M. (2008)

Pre-anesthetic Bloodwork

Primary Vet Literature-

The changes revealed by pre-operative screening were usually of little clinical relevance and did not prompt major changes to the anaesthetic technique...In dogs, pre-anaesthetic laboratory examination is unlikely to yield additional important information if no potential problems are identified in the history and on physical examination.

Alef, M. (2008)

Pre-anesthetic Bloodwork

Primary Vet Literature-

- 101 dogs
- Private practice
- > 7 years of age (avg=11)
- Routine and emergent cases
- 87% had no pre-existing conditions

Joubert, K.E. (2007)

Pre-anesthetic Bloodwork

Primary Vet Literature-

- New problem found- 29.7%
- Anesthesia cancelled- 12.9%
 - Further tests- 5.9%
 - Euthanized- 4%
 - Procedure postponed- 1%
 - Additional therapy- 1%
- Age did not predict abnormalities
- Abnormalities not associated with complications

Pre-anesthetic Bloodwork

Primary Vet Literature-

This study concluded that screening of geriatric patients important and that sub-clinical disease could be present in nearly 30 % of these patients. The value of screening before anaesthesia is perhaps more questionable in terms of anaesthetic practice but it is an appropriate time to perform such an evaluation.

Joubert, K.E. (2007)

Pre-anesthetic Bloodwork

Primary Vet Literature-

- 100 cats > 6 years old
- Not a pre-surgical population
- No known abnormalities on Hx
- Many not normal on PE

Paeppe, D. (2013)

Pre-anesthetic Bloodwork

Primary Vet Literature-

- Lots of abnormalities
 - 13% increased wbc
 - 29% increased creatinine
 - 15% increased BUN
 - 25% increased glucose
 - 4% increased T4
 - 6% increased ALT

Paepe, D. (2013)

Pre-anesthetic Bloodwork

Primary Vet Literature-

- Some new diagnoses
 - 14% FIV positive
 - 2% CKD
 - 1% hyperthyroidism
 - 1% UTI

Paepe, D. (2013)

Pre-anesthetic Bloodwork

Primary Vet Literature-

- Relevance to pre-anesthetic screening?
- Some abnormalities were related to choice of reference interval
- Many abnormalities were clinically irrelevant
- Not truly screening since some had PE abnormalities

Pre-anesthetic Bloodwork

Human Literature- Systematic Reviews

- CBC
 - Abnormal <1% to 5%
 - Change protocol- 0.1% to 2.7%
- Hemostasis
 - Abnormal 3.8-15.6%
 - Change protocol- rarely

Munro, J. (1997)

Pre-anesthetic Bloodwork

Human Literature- Systematic Reviews

- Biochemistry
 - Abnormal <1% to 5%
 - Change protocol- rarely
- Urinalysis
 - Abnormal 1-35.1%
 - Change protocol- 1% to 2.8%

Munro, J. (1997)

Pre-anesthetic Bloodwork

Human Literature- Systematic Reviews

- The tests reviewed produce a wide range of abnormal results, even in apparently healthy individuals.
- The clinical importance of many of these abnormal results is uncertain.
- The tests lead to changes in clinical management in only a very small proportion of patients, and for some tests virtually never.

Pre-anesthetic Bloodwork

Human Literature- Systematic Reviews

- The clinical value of changes in management which do occur in response to an abnormal test result may also be uncertain in some instances.
- The power of preoperative tests to predict adverse postoperative outcomes in asymptomatic patients is either weak or non-existent.
- For all the tests reviewed, a policy of routine testing in apparently healthy individuals is likely to lead to little, if any, benefit.

Munro, J. (1997)

Pre-anesthetic Bloodwork

Human Literature- Guidelines

- Don't obtain baseline laboratory studies in patients without significant systemic disease (ASA I or II) undergoing low-risk surgery
- Performing routine laboratory tests in patients who are otherwise healthy is of little value in detecting disease.
- Evidence suggests that a targeted history and physical exam should determine whether pre-procedure laboratory studies should be obtained.

American Society of Anesthesiologists

Pre-anesthetic Bloodwork

Bottom Line-

- If you test, you will find abnormalities
- The clinical significance of these abnormalities is unclear
- You will find more abnormalities if pre-test probability is high
 - Indication for test in Hx
 - Abnormality on PE
- There is no evidence testing healthy patients reduces morbidity or mortality

Pre-anesthetic Bloodwork

Bottom Line-

- What's the harm?
 - Expense
 - Risk of testing
 - Overdiagnosis
 - Expense
 - Stress
 - Direct harm

Vaccination & IMHA/ITP

P- healthy dogs & cats

I- routine vaccinations

C- no vaccination (fewer)

O- incidence of IMHA, ITP

Vaccination & IMHA/ITP

Synthetic Vet Literature- Systematic Reviews

None

Synthetic Vet Literature- CATs

None

Vaccination & IMHA/ITP

Primary Vet Literature-

- Case/control study
- Cases more likely to be vaccinated in previous month (26%) than controls (7%)
- Did not r/o pre-existing disease

Duval, D. (1996)

Vaccination & IMHA/ITP

Primary Vet Literature-

- 10% of cases vaccinated within 1 month
- No difference between cases and controls in time from vaccination to presentation

Carr, A.P. (2002)

Vaccination & IMHA/ITP

Primary Vet Literature-

- Proportion of dogs vaccinated within 2 months of onset not different between cases and controls
 - Cases- 16.1%
 - Controls- 44.4%

Davidow, E.B. (2004)

Vaccination & IMHA/ITP

Primary Vet Literature-

- Proportion of dogs vaccinated within 42 days of onset not different between cases and controls-
 - Cases- 8%
 - Controls- 14%

Huang, A.A. (2012)

Vaccination & IMHA/ITP

Primary Vet Literature-

- 4% vaccinated within 2 weeks

Reimer, M.E. (1999)

- 2.4% vaccinated within 2 weeks

Klag, A.R. (1993)

Vaccination & IMHA/ITP

Human Literature- Reviews

- Database of 4.2 million children
- 55 cases of IMHA reported 1991-2001
- No association with vaccination

Naleway, A.L. (2009)

Vaccination & IMHA/ITP

Human Literature- Reviews

- ITP only associated with MMR
- 1-3 children per 100,000 doses
- This is lower than the rate of ITP caused by the diseases MMR prevents! (1:3000 to 1:6000 cases)

Cecinati, V. (2013)

Vaccination & IMHA/ITP

Bottom Line-

- Little evidence vaccination causes IMHA/ITP
- No consistent temporal association
- Data are weak
- Overwhelming majority of vaccinated animals do not develop these diseases
- Infection can be a greater risk for IMHA/ITP than vaccination

Vaccination & IMHA/ITP

Bottom Line-

- Don't vaccinate more than necessary
- Don't vaccinate less than necessary
- Don't avoid vaccination out of fear of IMHA/ITP

Antibiotics & Dentistry

P- dogs & cats with periodontal disease

I- prophylactic antibiotics with dentistry

C- no antibiotics with dentistry

O- incidence of bacterial endocarditis

Antibiotics & Dentistry

Synthetic Vet Literature- Systematic Reviews

None

Synthetic Vet Literature- CATs

None

Antibiotics & Dentistry

Synthetic Vet Literature- Guidelines

...use of a systemically administered antibiotic is recommended to reduce bacteremia for animals that are immune compromised, have underlying systemic disease (such as clinically-evident cardiac, hepatic, and renal diseases) and/or when severe oral infection is present.

American Veterinary Dental College

Antibiotics & Dentistry

Primary Vet Literature-

- Retrospective review of records for ~59,000 dogs with periodontal disease

periodontal disease was associated with cardiovascular-related conditions, such as endocarditis and cardiomyopathy.

Glickman, L.T. (2009)

Antibiotics & Dentistry

Primary Vet Literature-

- Concerns about diagnostic criteria
- Many data inconsistent with previous findings
- Study design not appropriate to establish causal relationship

Glickman, L.T. (2009)

Antibiotics & Dentistry

Primary Vet Literature-

- Retrospective case (70)/control(80) study
- No association between dental disease or Tx and endocarditis

Peddle, G.D. (2009)

Antibiotics & Dentistry

Human Literature- Systematic Reviews

There remains no evidence about whether antibiotic prophylaxis is effective or ineffective against bacterial endocarditis in people at risk who are about to undergo an invasive dental procedure. It is not clear whether the potential harms and costs of antibiotic administration outweigh any beneficial effect.

Glenny, A.M. (2013)

Antibiotics & Dentistry

Human Literature- Guidelines

Today, antibiotics before dental procedures are only recommended for patients...who have:

- A prosthetic heart valve or who have had a heart valve repaired with prosthetic material.
- A history of endocarditis.
- A heart transplant with abnormal heart valve function
- Certain congenital heart defects

American Heart Association

Antibiotics & Dentistry

Human Literature- Guidelines

Antibiotic prophylaxis against infective endocarditis is not recommended:

- for people undergoing dental procedures
- for people undergoing non-dental procedures at the following sites:
 - upper and lower gastrointestinal tract
 - genitourinary tract
 - upper and lower respiratory tract
- Chlorhexidine mouthwash should not be offered as prophylaxis against infective endocarditis to people at risk of infective endocarditis undergoing dental procedures.

Antibiotics & Dentistry

Bottom Line-

- Endocarditis is rare
- Dental treatment is probably not a major risk factor for endocarditis
- Antibiotics with dentistry are probably not useful in preventing endocarditis

Antibiotics & Dentistry

Fun Fact!

Overall bacteremia in 6 blood samples-

- Extraction + amoxicillin- 56%
- Extraction + placebo- 80%
- Toothbrushing- 32%

Although amoxicillin has a significant impact on bacteremia resulting from a single-tooth extraction, given the greater frequency for oral hygiene, toothbrushing may be a greater threat for individuals at risk for infective endocarditis.

Lockhart, P.B. (2008)

Evaluation of Evidence

- PICO question
- Veterinary Synthetic Literature
 - Systematic Reviews
 - CATs
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- Bottom Line