Bladder Cancer Studies at a Glance (as of 09/14/20):

R = retrospective; P = prospective; Clinical Benefit %= RR%+SD% = Response rate (% of dogs acheving complete or partial remission)+Stable disease rate (tumor is neither growing or shrinking); PFI = Progression Free Interval(median time from treatment to progressive disease), MST = median survival time (from the time treatment began to death)

Study Protocol (linked to study)	# of Dogs	Trial type	Clinical Benefit %: RR%+SD%	PFI (days)	PFI Range (days)	MST (days)	MST Range (days)	Comments/Results	Ref
Piroxicam Alone	34	P	18%+53%= 71%	N/A	N/A	181	28 to 720+	Piroxicam toxicity consisted of gastrointestinal irritation in 6 dogs (18%) and renal papillary necrosis (detected at necropsy) in 2 dogs (6%)	Knapp 1994
Deracoxib/Deramaxx (Abstract Only)	24	P	17%+71%= 88%	133	N/A	323	N/A	Abnormalities attributed to deracoxib administration were noted in 4% Renal, 4% hepatice, and 19% gastrointestinal	Knapp 2011
Piroxicam (post Vinblastine failure)	20	P	15%+45%= 60%	N/A	N/A	531	N/A	Vinblastine was administered every 2 weeks without Piroxicam. 20 of the original 27 dogs in the Vinblastine Alone group elected to treat with Piroxicam given orally once per day once the Vinblastine failed. Response rates pertain to the Piroxicam given after Vinblastine failed.	Knapp 2016
Vinblastine/Piroxicam	24	P	58%+33%= 92%	199	21-593	299	21-637	Vinblastine was administered every 2 weeks plus Piroxicam was given orally once per day. 21% of dogs experienced gastrointestinal toxicity with only 4% at grades 3-4. 29% of dogs experienced hematologic toxicity with 13% at grades 3-4.	Knapp 2016
Vinblastine Alone	27	P	22%+70%= 93%	143	1-1,015	407	13-1132	Vinblastine was administered every 2 weeks without Piroxicam. 19% of dogs experienced gastrointestinal toxicity at low grade levels (1-2). 48% of dogs experienced hematologic toxicity with 15% at grades 3-4.	Knapp 2016
Vinblastine	28	P	36%+50%= 86%	122	28-399	147	28-476	Vinblastine was administered every 2 weeks. Mean number of treatments were 8. Dosage reductions were performed because of neutropenia in 16 dogs (57%) and grade 3 GI toxicosis in 1 dog (4%). Of the 28 dogs, 11 (39.3%) had grade 3 or 4 neutropenia during the course of their treatment	Knapp 2011
Vinblastine/Toceranib (Palladia)	10	P	20%+30%= 50%	N/A	N/A	N/A	N/A	Vinblastine was administered every 2 weeks and Toceranib(Palladia) was given orally on Monday, Wednesday and Friday for 16 weeks. NSAID's were continued on off days from Toceranib. Omeprazole was given daily. Most common adverse event was gastrointestinal and were all at grade 1 or 2. Second most common adverse event was hematologic with most events at grades 1-2 except for two instances of neutropenia at grades 3-4 and a grade 4 elevation of ALT.	Rippy 2016
Piroxicam with Mitoxantrone	26	P	8%+69%= 77%	106	21 to 383	248	N/A	Mitoxantrone was administered every 3 weeks concurrently with piroxicam daily. 7 dogs (27%) had dose reductions because of adverse events. Neutropenia was noted in 40% of the dogs.	Allstadt 2015
Mitoxantrone and Piroxicam	48	P	35%+46%= 81%	194	0 to 460	350	10 to 675	75% of the dogs were noted to exhibit clinical improvement based on a subjective measurement. Toxicity noted with this protocol included GI irritation in 18% of dogs, neutropenia in 10%, and renal failure unattributable to other causes in 6% of dogs with complete follow-up. GI irritation was attributed to Piroxicam alone as it had the same GI toxicit as the Piroxicam alone study.	Henry 2003
Carboplatin/Piroxicam	29	P	38%+45%= 83%	N/A	N/A	161	N/A	4.0 average doses of carboplatin every three weeks with daily oral Piroxicam were given.Gastrointestinal toxicity observed in 74% of dogs ranging from mild to severe, hematologic toxicity observed in 35% of dogs, also ranging from mild to severe.	Knapp 2005

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Piroxicam with Carboplatin	24	P	13%+54%= 67%	74	13 to 548	263	N/A	Carboplatin was administered every 3 weeks concurrently with piroxicam daily. 3 (13%) dogs had dose reductions due to adverse events. Gastrointestinal toxicosis was noted in 26% of the carboplatin-treated dogs. study	Allstadt 2015
Intravenous Carboplatin	15	R	13%+60%= 73%	N/A	N/A	N/A	N/A	No previous treatments for the study participants. Various NSAIDS were also used orally in conjunction with 3 treatment cycles of Carboplatin. Total of 44 treatments were given to the study population. Anemia was experienced in 41% of the treatments, neutropenia in 50%, thrombocytopenia in 14%, lethargy and anorexia in 23%, diarrhea in 18% of the treatments.	Culp 2015
Intraarterial Carboplatin	11	R	36%+64%= 100%	N/A	N/A	N/A	N/A	No previous treatments for the study participants. Carboplatin and Meloxicam (NSAID) were both given intraarterially for 2 treatment cycles. There were 2 (9%) procedural complications and 3 post procedural events such as mild lameness in 9% and 1 ischemic event leading to blindness. Neutropenia was experienced in 36% of the treatments and diarrhea in 9% of the treatments.	Culp 2015
Cisplatin followed by Piroxicam	8	P	0%+50%= 50%	84	42 to 151	309	140 to 518	Once the dogs experienced progressive disease, Piroxicam was given while Cisplatin was discontinued. The MST data is based on this combination protocol. Renal toxicity was reported in 50% of the dogs. Hematologic toxicity occurred in 36%. Gastrointestinal toxicity occurred in 38%.	Knapp 2000
Cisplatin/Piroxicam	14	P	71%+14%= 86%	124	46 to 259	246	46 to 810	Renal toxicity of cisplatin/piroxicam was reported in 86% of the dogs. Hematologic toxicity occurred in 36%. Gastrointestinal toxicity occurred between 50% and 65% but were generally mild.	Knapp 2000
Cisplatin	15	P	13%+53%= 67%	87	N/A	338	N/A	Cisplatin was given every 3 weeks. 93% experienced gastrointestinal side effects with 40% at grade 3 or grade 4 levels. Hematologic toxicity occurred 60% with 20% at Grade 3 or 4. Renal toxicity in 33%.	Knapp 2012
Cisplatin/Firocoxib	14	P	57%+21%= 79%	186	N/A	179	N/A	Cisplatin was given every 3 weeks along with Firocoxib given orally once per day. 66% experienced gastrointestinal side effects with 58% at grade 3 or grade 4 levels. Hematologic toxicity occurred 36% with 0% at Grade 3 or 4. Renal toxicity in 45%.	Knapp 2012
Firocoxib	15	P	20%+33%= 53%	105	N/A	152	N/A	Firocoxib was given orally once per day. 33% experienced gastrointestinal side effects with 7% at grade 3 or grade 4 levels. Hematologic toxicity occurred 7% with 0% at Grade 3 or 4. Renal toxicity in 15%.	Knapp 2012
Gemcitabine/Piroxicam (Abstract Only)	38	P	26%+50%= 76%	N/A	N/A	230	N/A	Median of 8 weekly treatments were given with a range of 1 to 38 treatments per dog in this study. 68% had gastrointestinal toxicity (Grade 1-3) and 26% had neutropenia toxicity (Grade 1-3). All dogs had improvement in clinical signs.	Marconato 2011
Doxorubicin/Piroxicam (Abstract Only)	23	R	9%+61%= 70%	103	N/A	168	N/A	3.5 average doses of doxorubicin every three weeks with daily oral Piroxicam were given. Gastrointestinal toxicity were generally mild.	Robat 2013

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Folate-tubulysin	28	P	11%+61%= 71%	103	24 to 649	N/A	N/A	Folate-tubulysin was given intravenously every two weeks. This study was determining a maximum tolerated dose for safety of this targeted chemotherapy drug. The majority of the dogs presented with advanced age, cancer stage, and/or co-morbidities. No dog withdrew from the study due to an adverse event or negative effects towards quality of life. Toxicity noted consisted of neutropenia, anorexia, or lethargy.	Knapp 2018
Chlorambucil	30	P	3%+67%= 70%	119	7 to 728	221	7 to 747	29 of the 30 dogs had received prior treatments. Only 7 of the 30 (23%) dogs had toxicoses, and those toxic effects were typically mild. Only 1 dog (3%) had a grade 3 toxicosis, and that was not detected until 20 months after chlorambucil treatment was started	Knapp 2013
Palladia - Abstract Only (Contact me for full study)	37	R	7%+80%= 87%	96	30 to 599	149	5 to 710	56% of dogs had progression of azotemia (excess of nitrogen in the blood which could lead to kidney failure) while receiving Palladia. All dogs had at least one adverse event, but most were transient and mild (grades 1 and 2). 34 of the 37 dogs received prior treatment before receiving Palladia with an average of two different chemotherapy drugs. 21 of the dogs also took an NSAID on the days they didn't take Palladia.	Gustafson 2019
Intensity-Modulated and Image-Guided Radiation Therapy	21	R	N/A	317	N/A	654	N/A	Total radiation dose ranged from 54–58 Gy, delivered in 20 daily fractions. Grade 1 and 2 acute gastrointestinal toxicoses developed in 33% and 5% of dogs, respectively. Grade 1 and 2 acute genitourinary and grade 1 acute integumentary toxicoses were documented in 5%, 5%, and 20% of dogs, respectively. 4/21(19%)dogs experienced late grade 3 gastrointestinal or genitourinary toxicosis. Each presented 6–18 months after completion of IM/IGRT, and was successfully palliated with either stenting or surgery. 60% noted subjective improvement in quality of life and 30% remained unchanged.	Nolan 2012
Palliative Radiation	13	R	62%+38%= 100%	N/A	N/A	150	25 to 763	10 daily (M-F) fractions of 2.7 Gy. 6 dogs used this treatment as first line therapy and 7 dogs used this as a rescue therapy after trying chemotherapy. Clinical Benefit was measured within 6 weeks of radiation. Acute side effects occurred in 31% of patients at a low grade 1 or 2. Late stage side effects were not found. Subjective clinical improvment was found in 77% of dogs.	Choy 2016
Piroxicam, Mitoxantrone and Course Fraction Radiotherapy	10	R	20%+50%= 70%	91	61 to 219	326	9 to 775+	Treated with a combination of once-weekly coarse fraction radiation therapy (six weekly fractions of 5.75 Gray [Gy]), mitoxantrone chemotherapy every three weeks and piroxicam daily. Only 1 dog (10%) experienced accute effects from the radiation (Grade 1 dermititis) while 4 dogs (40%) experienced late stage side effects from the radiation (30% incontinence and 10% cutaneous hyperpigmentation). Nine of 10 dogs (90%) had clinical amelioration of their urinary tract signs.	Poirier 2004
Partial Cystectomy (Abstract Only)	37	R	N/A	235	N/A	348; 772 with Piroxicam	N/A	Dogs with non-trigonal bladder TCC treated with full thickness partial cystectomy and daily piroxicam (+/− chemotherapy) may have improved outcome compared to dogs treated with medical therapy.	Marvel 2017

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Laser Ablation (Abstract Only) See Letter to the Editor below	38	P	N/A	N/A	N/A	380	11 to 1,906	Complications were stranguria, hematuria, stenosis at the cystourethral junction, spread of TCC within the lower urinary tract, spread to the urethrostomy site, urethral perforation, and bacterial cystitis.	Cerf 2012
Laser Ablation (Letter to the Editor)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	This is a rebuttal to the Laser Ablation study above from Dr. Knapp at Purdue. A full understanding of the risks and benefits of laser ablation requires further study.	Knapp 2012
Laser Ablation with Piroxicam and Mitoxantrone	8	P	N/A	200	N/A	299	N/A	Adverse treatment effects were observed in 2 dogs; signs included mild, self-limiting inappetance and lethargy. Although survival times achieved with CO2 laser ablation and treatment with mitoxantrone and piroxicam were similar to survival times associated with chemotherapy alone, resolution of clinical signs was better with the combined treatment.	Upton 2006
Urethral Stents	26	R	N/A	N/A	N/A	5 Months	1 to 48 Months	The most common complication reported was urinary incontinence and occurred in 8 of 26 (30.7%) patients with 5 of 18 (27.7%) being female. Two patients developed urethral obstruction poststent placement. One patient experienced inability to urinate 3 days poststent placement, which resolved after urethral catheterization. Hematuria (blood in urine), stranguria (straining to urinate), or both were observed in 20 of 26 patients (77%) but this finding was present before stent placement and all affected patients had a neoplastic process.	Radhakrishnan 2017
Urethral Stents	19	R	N/A	N/A	N/A	78	2 to 366	Complications following stent placement in 18 dogs included incontinence (n = 7), reobstruction from continued growth of urethral TCC (3), acute reobstruction shortly after the procedure (1), and stent migration (2). Of the 17 owners surveyed, 16 were satisfied with the outcome and would recommend urethral stent placement.	Knapp 2012