Update on Meloxicam (Mobicox®) & COX-2 Selectivity

COX-2 Selectivity/Specificity

- ◆There is a lot of discussion regarding the relative COX-2 selectivity of meloxicam compared to celecoxib (Celebrex®) and rofecoxib (Vioxx®). A December 2000 RxFiles Q&A Summary regarding meloxicam stated that it had "relatively selective but not specific COX-2 inhibition" as discussed in a variety of literature. 1,2,3,4,5 Boehringer Ingelheim (Canada) Ltd. (BICL) has been detailing meloxicam as an agent with COX-2 selectivity comparable to celecoxib based on data from BICL sponsored work of Warner et al.⁶ This research measured NSAID inhibition of COX-1 when COX-2 enzyme activity is inhibited by 80%. It found that both meloxicam and celecoxib were 5-50 fold selective for COX-2, with rofecoxib being >50 fold COX-2 selective. The interpretation of studies measuring relative COX-2 to COX-1 selectivity is subject to much debate due to differences in the various assays used. As with rofecoxib and celecoxib, meloxicam does not appear to affect platelet aggregation, a trait that supports high COX-2 selectivity.
- ◆The fight over the COX-2 market share has resulted in discussion regarding the suitability of the term "COX-2 specific" which has been used for both celecoxib and rofecoxib. According to a recent memorandum, the Pharmaceutical Advertising Advisory Board (PAAB) has stated that "no product has received approval for use of the term "COX-2 specific" in advertising because it is not in the product monograph of any of the three drugs" (Mobicox®, Vioxx®, and Celebrex®). A look at current evidence regarding actual safety data (e.g. risk of complicated GI ulcers) will be more relevant to this discussion.

GI Tolerability and Safety

- •Unfortunately no head-to-head clinical data is available to compare rofecoxib or celecoxib to meloxicam.
- ◆Two large-scale, short-term 28day trials have assessed the GI tolerability of meloxicam (**see Table**):
 - •MELISSA⁸ showed that compared to diclofenac SR 100mg/day, meloxicam 7.5mg/day caused less GI related adverse drug reactions (ADRs) (13% vs 19%; p=0.001). These ADRs included dyspepsia, nausea & vomiting, abdominal pain and diarrhea. There were 5 (0.1%) serious GI events defined as perforations, ulcers, or bleeds (PUBs) in the meloxicam group compared to 7 (0.15%) in the diclofenac group. While this showed a positive trend it was not statistically significant.
 - **SELECT**9 showed that compared to piroxicam 20mg/day, meloxicam 7.5mg/day caused less GI related ADRs (10.3% vs 15.4%; p=0.001). There were 7 (0.16%) serious GI events (e.g. PUBs) in the meloxicam group compared to 16 (0.37%) in the piroxicam group. Again the difference lacked statistical significance.
- ◆The **short duration** and **low-doses** (7.5mg OD) used make it difficult to evaluate the risk for serious GI ADRs; GI ulcer risk can increase greatly with higher NSAID dosages.
- •A meta-analysis reporting on 12 randomized meloxicam trials suggests that compared to non-COX-2 selective NSAIDs, meloxicam has fewer GI ADRs, less dyspepsia, fewer PUBs, and less frequent discontinuation due to

adverse GI events.¹⁰ This data must be cautiously interpreted due to the inherent limitations of the meta-analysis, such as variability of trial outcomes, and the low dosage of meloxicam used in most trials.

- •Meloxicam appears to have better GI tolerance than nonselective NSAIDs. To what extent ulcers and complicated ulcers are also reduced remains to be established.
- •Major trials evaluating the safety of the other COX-2 selective drugs, **celecoxib** (Celebrex[®]) and **rofecoxib** (Vioxx[®]) have been published. These trials differ from the large-scale meloxicam trials as **dosages were 2-4X higher than usually recommended and trial length was longer** (see Table).
 - ■The CLASS¹¹ study compared celecoxib to non-selective NSAIDs (ibuprofen and diclofenac). The risk of "GI ulcer complications + symptomatic ulcers" were significantly reduced; however significant reductions in complicated ulcers was reduced only for the study arm where patients on ASA were excluded.
 - ■The VIGOR¹² study compared rofecoxib to naproxen and found significant reductions in complicated ulcers in rofecoxib patients. As opposed to the CLASS trial, ASA patients were excluded from the study and a small increase in risk of acute MI was seen.
- •These trial results pose many more questions that will require further study (& more updates).

Approximate cost per 30 day prescription in SK (includes allowable markup and dispensing fee):

- ◆naproxen 375mg po BID (~ \$16)
- ◆meloxicam 7.5mg po OD (~ \$32)
- ◆celecoxib 200mg po OD (~ \$52)
- ◆rofecoxib 12.5mg po OD (~ \$52)

Prepared by Loren Regier BSP, BA in consultation with RxFiles advisors & reviewers.

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¹ Jackson LM, Hawkey C. COX-2 Selective Nonsteroidal Anti-inflammatory Drugs. Drugs 2000;59(6):1207-16.

² Kaplan-Machlis B, Klostermeyer BS. The Cyclooxygenase-2 Inhibitors: Safety and Effectiveness. Ann Pharmacother 1999;33:979-88.

³ Meloxicam and selective COX-2 inhibition: the evidence for improved gastrointestinal tolerability. Drugs and Therapy Perspectives 1996;8(2):1-4.

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⁵ Tegeder I, Lotsch J, Krebs S, Muth-Selbach U, Brune K, Geisslinger G. Comparison of inhibitory effects of meloxicam and diclofenac on human thromboxane biosyntheses after single doses and at steady state. Clin Pharmacol Ther 1999;65:533-44.

⁶ Warner TD, Giuliano F, Vojnovic I, Bukasa A, Mitchell JA, Vane JR. Proc Natl Acad Sci USA 1999;96:7563-8.

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⁸ Hawkey C, Kahan A, Steinbruck K, et al. Gastrointestinal tolerability of meloxicam compared to diclofenac in osteoarthritis patients. International MELISSA Study Group. Br J Rheumatol 1998;37:937-45.

⁹ Dequeker J, Hawkey C, Kahan A, et al. Improvement in gastrointestinal tolerbility of the selective cyclogenase (COX)-2 inhibitor meloxicam, compared with piroxicam: Results of the Safety and Efficacy Large-scale Evaluation of COX-inhibiting Therapies (SELECT) trial in osteoarthritis. Br J Rheumatol 1998;37:946-51.

osteoarthritis. Br J Rheumatol 1998;37:946-51.

¹⁰ Schoenfeld P. Gastrointestinal safety profile of meloxicam: a meta-analysis and systematic review of randomized controlled trials. Am J Med 1999;107:48S-54S.

¹¹ Langman MJ, Jensen DM, Watson DJ, et al. Adverse upper gastrointestinal effects of celecoxib

Langman MJ, Jensen DM, Watson DJ, et al. Adverse upper gastrointestinal effects of celecox compared with NSAIDs (CLASS). JAMA 1999;282:1929-33.
 Bombardier C, Laine L, Reicin A, et al. Comparison of upper gastrointestinal toxicity of

¹² Bombardier C, Laine L, Reicin A, et al. Comparison of upper gastrointestinal toxicity of rofecoxib and naproxen in patients with rheumatoid arthritis (VIGOR). NEJM 2000;343:1520-1528. {^{II,I2} Note: additional study results (CLASS/VIGOR) - www.fda.gov/ohrms/docket}

MELOXICAM (Mobicox®)

Study	Drug & Dose	Duration	# pts	Any GI adverse event – 28days	Perforations or Bleeds	Perforations, Ulcers, or Bleeds	Any event causing	Comments
				(dyspepsia, etc.)	- 28 days	(PUBs) - 28days	DC	
MELISSA 8	Meloxicam 7.5mg OD	28 days	4635	13%	0	0.1%	7.2%	 ◆higher hospitalization rate in diclofenac group
(n=9323)	Diclofenac 100mg SR OD	OA	4688	19%	4	0.15%	9%	◆diclofenac group had more pts age >65 & pts with hx of PUBs
Mean age=61.5				(p<0.001)	not significant	not significant	(p=0.0014)	•more pts in meloxicam group discontinued due to lack of
							(due to ADR	efficacy but less due to adverse reactions.
							or ↓efficacy)	
SELECT 9	Meloxicam 7.5mg OD	28 days	4320	10.3%	0	0.16%	6.13%	◆piroxicam group: more >65yo; but less with a hx of PUBs
(n=8656)	Piroxicam 20mg OD	OA	4336	15.4%	4	0.37%	7.24%	•withdrawals due to GI adverse events less with meloxicam vs
Mean age=61.5				(p<0.001)	not significant	not significant	(p=0.06) NS	piroxicam (3.79% vs 5.26%) p<0.01%

What we know: •meloxicam was better tolerated and caused fewer withdrawals due to GI adverse events than non-selective NSAIDs.

What we don't know: * whether meloxicam significantly reduces the risk of complicated and symptomatic ulcers compared to non-selective NSAIDs can not be determined from these trials; differences shown in these studies were not statistically significant and the low-dose (1/2 usual maximum) and short duration (28days) of the studies makes interpretation difficult.

Meloxicam long-term data: Has been used outside of North America since 1996: >30million prescriptions in > 90 countries); One abstract reports clinically significant GI ADRs/pt-vear=0.3 & 0.6 (for 7.5 & 15mg/d dose).

CELECOXIB (Celebrex®) & ROFECOXIB (Vioxx®) Detailed study results for CLASS & VIGOR obtained from submission to FDA arthritis advisory committee Feb01 - http://www.fda.gov/ohrms/docket

Study	Drug & Dose	Duration	# pts	Any GI adverse events	GI ulcer complications / 100 pt-yrs	GI ulcer complications + symptomatic ulcers / 100 pt-yrs	Any event causing DC	Comments *supratherapeutic doses used to definitively test safety *'ulcer complications' defined as: upper GI bleeding, perforation, or gastric obstruction
CLASS 11	Celecoxib 400mg BID	≤6mo;	3987	45.6% .	0.76	2.08	22.4% .	◆dose of celecoxib <u>2X usual max</u> daily dose
	Ibuprofen 800mg TID	ave 4.2mo	1985	46.2% NS	1.45	3.54	23.0% NS	•only 4573 completed full 6 month trial; high drop out rate
(n=7968)	Diclofenac 75mg BID	OA or RA	1996	55.0% (p<0.05)	(p=0.09)	(p=0.02)	26.5% .	• > withdrawal rate due to GI ADR in diclofenac group (16.6%
(,		72%			not significant	NNT=68.5		vs 12.2% for celecoxib) may have underestimated its GI risk
Mean age=60	Subgroup: as above but				0.44	1.40		• differences in GI ulcers/complications were found for celecoxib versus ibuprofen (2.08 vs 4.31/100 pt-yrs; p=0.005) but
(~12% >75)	excluding patients on	ASA appe	ared to be	an independent	1.27	2.91		not celecoxib vs diclofenac (possibly due to > withdrawal rate)
(range 18-90)	nge 18-90) ASA ≤325mg/d cause of ulcers in celecoxib pt				(p=0.04)	(p=0.02)		•pts at ↑ risk for GI events also had ↑ withdrawal rates
	for NSAIDs (RR =4.5).				NNT=120	NNT=66		•fewer celecoxib pts had GI blood loss, GI intolerance
	Subgroup: as above but			1	2.01	4.7		◆no difference in CV events (but ASA allowed in study)
	including patients on	2% of each treat	o of each treatment arm had concurrent ASA		2.12	6.0		◆celecoxib arm had more pts > 65yo & hx of upper GI bleeds
	ASA ≤325mg/d	2270 of each treatment ann had		lad concurrent 71571	(p=0.92)	(p=0.49)		•rash with high-dose celecoxib (6.2%); appears to be dose-
	<u> </u>				not significant			dependent T from previous data; (sulfa allergy pts excluded)
VIGOR 12	Rofecoxib 50mg OD	≤13mo;	4047	32.6%	0.59	2.08	15.9% .	◆dose of rofecoxib 2X usual max daily dose
	Naproxen 500mg BID	mean	4029	36%	1.37	4.49	15.8% NS	•acute MI > in rofecoxib than naproxen (0.5% vs 0.1%)
(n=8076)		8mo			(p=0.005)	(p=0.001)		•DC due to hypertension > in rofecoxib (0.7% vs 0.1%);
(== ==, =)					NNT=128	NNT=41.5		HTN & edema appear to be dose dependent (previous data)
Mean age 58;		RA		SA patients were exc				◆DC due to GI ADR lower in rofecoxib (RR = 0.73; p<0.001) ◆similar incidence of rash (rofecoxib vs naproxen 3.5% vs 3%) ◆better GI safety but some adverse outcomes related to non-GI
(only $\sim 5\% > 75$)			ha	ave been indicated in ~				
(range 34-89)		~28% OF CONTIFMED C	cardovascular thrombotic events			events; ASA pts excluded; •rofecoxib arm had less pts age >65		
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What we know:

- •rofecoxib reduced the risk of complicated &/or symptomatic ulcers but increased the risk of acute MI compared to the non-selective NSAID, naproxen.
- *celecoxib significantly reduced the risk of complicated &/or symptomatic ulcers compared to ibuprofen
- •risk of serious ulcer complications in patients on celecoxib and low-dose ASA was not significantly different from those on non-selective NSAIDs and ASA.

- What we don't know: •whether risk of serious GI toxicity in patients on rofecoxib and ASA would be reduced compared to patients on non-selective NSAIDs and ASA.
 - whether the safety profile would be significantly improved in patients on a usually recommended or lowest effective dose as opposed to supratherapeutic doses from trials.
 - •whether COX-2 selective agents are significantly safer in high-risk patients (e.g. the very elderly ≥75yrs or patients with previous hx of ulcers).
 - •how the selective COX-2 agents compare to each other in terms of overall safety or efficacy. (No head-to-head trials; different trial designs.)

Celecoxib long-term data: Study 024: ulcer complication rate of 0.23% (≤2 years exposure); postmarketing surveillance incidence of ulcer complications <0.02%: 30 fatal GI events in 1999; acute renal failure 0.0039%. Rofecoxib long-term data: postmarketing surveillance - 59 complicated PUBs in 1999 (but only approved May/1999); complicated upper GI events = 0.014 per 100 pt-yrs;

Background rate of ulcers: estimated to be approximately 0.1 to 0.4 events per patient years (varying as function of patient age); general ulcer rate for NSAIDs is thought to be ~2-4% per year; risk \(^{\}\)'s with \(^{\}\)'d dose; acute renal failure secondary to NSAIDs = 15-20 per 100,000 pt-yrs; NSAIDs account for 16,500 deaths/year in the USA

Of interest, MUCOSA study: misoprostol (200mcg po qid) \downarrow 'd the rate of serious complicated upper GI events from 0.95% to 0.56% for NSAID users with RA over 6 months (ARR = 0.4%; NNT=250)

DC=discontinuation: OA=osteoarthritis: RA=rheumatoid arthritis: vo=vears old: NS=not (statistically) significant: GI=gastrointestinal: ADR=adverse drug reaction: CV =cardiovascular: pts =patients: hx =history.



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