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Equianalgesic Dosing of Opioids for Pain Management

Equianalgesic doses contained in this chart are **approximate** and should be used only as a guide. Dosing must be titrated to individual response. There is often incomplete cross-tolerance among opioids. **Therefore, many experts recommend beginning with a 25% to 50% lower dose than the published equianalgesic dose when changing drugs and then titrating** to a safe/effective response.[2-4,48] Dosing adjustments for kidney or liver insufficiency, cytochrome P450 drug interactions, genetics, and other conditions or medications that affect drug metabolism, kinetics, or response may also be necessary.[2,34] Also consider pain control at time of switch.[3,4,48] In general, use cautious dosing for elderly or debilitated patients, and patients with kidney or liver impairment. (some products have specific dosing recommendations for these populations [**see footnotes**]).[2,34] See our Opioid Conversion Algorithm below (following this chart) for instructions on converting from one opioid to another.

An equianalgesic dose calculator is available at http://agencymeddirectors.wa.gov/Calculator/DoseCalculator.

Drug	**Equianalgesic Doses (mg)**[1,3,4,34,41,70]		**Approximate Equianalgesic 24-hour Dose (Assumes Around-the-Clock Dosing)**[g]		**Usual Starting Dose (for Opioid-Naive Adults) (*Doses are NOT Equianalgesic)**	
	Parenteral	**Oral**	**Parenteral**	**Oral**	**Parenteral**	**Oral**
Morphine (immediate-release tablet, capsule [Canada], oral solution, injection)	10	30	3 to 4 mg Q4H	10 mg Q4H	2 to 10 mg Q4H (acute or chronic pain)[50]	10 mg Q4H[41] (can start with 5 mg [per Canadian labeling] or 15 mg to 30 mg [per US labeling])[10,24]
Extended-release morphine (*MS Contin*, *Kadian*, *Arymo ER* [US], *M-Eslon* [Canada])	NA	30 See footnote e.	NA	30 mg Q12H *Kadian*: 30 mg Q12H or 60 mg Q24H[6,21,e]	NA	**US**: 15 mg Q8-12H[29,53,c] **Canada** (*MS Contin*, *M-Eslon*): individualize; most common initial dose is 30 mg Q12H[9,57,c] ***Kadian* is not for opioid-naive** patients.[6,21]

Drug	**Equianalgesic Doses (mg)**[1,3,4,34,41,70]		**Approximate Equianalgesic 24-hour Dose (Assumes Around-the-Clock Dosing)**[g]		**Usual Starting Dose (Opioid-Naive Adults) (Doses NOT Equianalgesic)**	
	Parenteral	**Oral**	**Parenteral**	**Oral**	**Parenteral**	**Oral**
Hydromorphone (*Dilaudid*)	1.5	6 to 7.5	0.4 mg Q4H	2 mg Q4H	See footnote a	2 mg Q4-6H[41] See footnote a.
Controlled-release hydromorphone (*Hydromorph Contin* [Canada])	NA	6	NA	6 mg Q12H	NA	3 mg Q12H[30,c]
Extended-release hydromorphone (US only, generics)	NA	See footnote b.	NA	See footnote b.	NA	Not for opioid-naive patients.[13]
Oxycodone (e.g., *Roxicodone* [US], *Oxy IR* [Canada], also in *Percocet* [US], others)	NA	20	NA	5 to 10 mg Q4H	NA	5 to 15 mg Q4-6H (US);[42] 5 to 10 mg Q6H (Canada)[43] (product labeling)
Extended-release oxycodone (*OxyContin* [US], *OxyNeo* [Canada]), *Xtampza ER* [US])	NA	20 See footnote h.	NA	20 mg Q12H	NA	10 mg Q12H[5,7] (*Xtampza ER*: 9 mg Q12H[66])[c]
Controlled-release oxycodone/naloxone (Canada only, *Targin*)	NA	20	NA	20/10 mg Q12H	NA	10/5 mg Q12H.[11,c]
Oxymorphone (US only, generics only)	NA	10	NA	5 mg Q6H	NA	10 to 20 mg Q4-6H (acute pain)[44,d] 5 to 10 mg Q4-6H[41] (acute/chronic noncancer pain guidelines)
Extended-release oxymorphone (US only, generic only)[i]	NA	10	NA	10 mg Q12H	NA	5 mg Q12H[59,c]

Drug	**Equianalgesic Doses (mg)**[1,3,4,34,41,70]		**Approximate Equianalgesic 24-hour Dose (Assumes Around-the-Clock Dosing)**[g]		**Usual Starting Dose (Opioid-Naive Adults) (Doses NOT Equianalgesic)**	
	Parenteral	**Oral**	**Parenteral**	**Oral**	**Parenteral**	**Oral**
Extended-release hydrocodone bitartrate (US only, *Zohydro ER*, *Hysingla ER*)	NA	See footnote f.	NA	See footnote f.	NA	*Zohydro ER*: 10 mg Q12H (chronic pain)[58,c] *Hysingla ER*: 20 mg Q24H (chronic pain)[62,c]
Hydrocodone bitartrate/acetaminophen (US only, *Norco*, *Lortab*)	NA	30	NA	10 mg Q4H	NA	7.5 mg Q4 to 6H[45]
Benzhydrocodone/acetaminophen (US only, *Apadaz*)	NA	~25[52] See footnote f.	NA	8.16 mg Q4H	NA	1 to 2 tablets Q4-6H (acute pain only [up to 14 days' use])[52]
Codeine A weak opioid.[1] Analgesic efficacy limited by a dose ceiling.[12] Codeine may have a lower abuse risk compared to more potent opioids.[68]	100 to 120	200	30 mg Q4H	60 mg Q4H	NA	15 to 60 mg Q4H (product labeling)[46] 30 mg Q4-6H (acute/chronic noncancer pain guidelines)[41]
Controlled-release codeine (Canada only, *Codeine Contin*) Reduce dose by 25% when switching from oral **codeine** phosphate (75% codeine base) due to phosphate content of tablet.[49] *Codeine Contin* doses expressed as codeine base.[49] A weak opioid.[1] Analgesic efficacy limited by a dose ceiling.[12]	NA	200	NA	200 mg Q12H	NA	50 mg Q12H[49,c]

Drug	**Equianalgesic Doses (mg)**[1,3,4,34,41,70]		**Approximate Equianalgesic 24-hour Dose (Assumes Around-the-Clock Dosing)**[g]		**Usual Starting Dose (Opioid-Naive Adults) (Doses NOT Equianalgesic)**	
	Parenteral	**Oral**	**Parenteral**	**Oral**	**Parenteral**	**Oral**
Methadone (*Dolophine* [US], *Metadol* [Canada]) Relatively safe choice in kidney or liver insufficiency.[54,55]	Variable	Variable	**For opioid-tolerant patients only**.[35] The conversion ratio of methadone is highly variable depending on factors such as patient tolerance, opioid dose, and length of dosing (short-term versus chronic dosing). Some experts recommend that only those with substantial experience with its use should prescribe methadone.[39,55]			
Meperidine (*Demerol*)	75 to 100	300	**Avoid** due to poor efficacy and neurotoxicity (seizures, myoclonus, tremors, agitation, delirium, confusion), especially in patients with kidney or liver dysfunction or the elderly, due to accumulation of the metabolite normeperidine.[1,4,16,17]			
Oliceridine (US only, *Olinvyk*)	2 mg[18]	NA	0.5 mg Q3H	NA	1.5 mg, then 0.75 mg Q1H[18]	NA
Fentanyl Relatively safe choice in kidney insufficiency or cirrhosis.[4,55] Clearance reduced by uremia.[54] Do not start patch in kidney failure, and avoid patch in advanced liver disease.[54] Watch for delayed toxicity.[54,55]	0.1	NA	All noninjectable fentanyl products are **for opioid-tolerant patients only (i.e., taking 60 mg or more of morphine or its equivalent daily for at least 1 week)**. Do **not** convert mcg for mcg among fentanyl products (i.e., patch, transmucosal lozenge, buccal tablet, nasal spray, sublingual tablet), sublingual spray. See specific product labeling for dosing. **Patch product labeling** recommendations (e.g., switch patients **from** oral morphine 60 to 134 mg daily or its equivalent **to** fentanyl 25 mcg/hour patch) are conservative.[63,64] Therefore, reversing this conversion (i.e., **from the patch to another opioid**) is NOT recommended as it can lead to overdose.[63,64] Some experts use a conversion factor of oral morphine 60 mg = fentanyl patch 25 mcg/hour in patients with chronic cancer pain, and round up or down based on patient factors, available patch sizes, and clinical judgment.[56] In the US "intermediate" patch strengths not studied in clinical trials (37.5 mcg/hour, 62.5 mcg/hour, 87.5 mcg/hour) are available for use during conversion or titration for patients who would normally be converted/stepped up to the 50 mcg/hour, 75 mcg/hour, or 100 mcg/hour patch, but for whom these doses might be too high.[65]			

Atypical Opioids: analgesics with mixed receptor effects and dose ceilings	
Buprenorphine: partial mu receptor agonist/kappa receptor antagonist[40]	***Butrans*** (transdermal patch): initial dose for patients taking <30 mg of oral morphine or equivalent per day (including opioid-naive) is a 5 mcg/hour patch applied once weekly (Canada: start with 5 mcg/hour patch in opioid-naive patients, and 5 to 10 mcg/hour patch in patients taking up to 80 mg oral morphine equivalents per day).[47,60] US: When converting patients taking 30 to 80 mg of oral morphine equivalents daily dose, first taper to 30 mg oral morphine equivalent per day (to reduce risk of precipitated withdrawal), then start with the 10 mcg/hour patch.[60] The maximum dose is one 20 mcg/hour patch once weekly.[47,60] ***Belbuca*** (buccal film): initial dose for opioid-naive patients is 75 mcg once daily or Q12H. For patients taking opioids, first taper the dose to 30 mg oral morphine equivalent per day (to reduce risk of precipitated withdrawal), then choose a *Belbuca* dose based on the previous opioid dose: 75 mcg once daily or Q12H (<30 mg/day oral morphine equivalent), 150 mcg Q12H (30 to 89 mg/day oral morphine equivalent), or 300 mcg Q12H (90 to 160 mg/day oral morphine equivalent).[67] Consider an alternative agent for patients taking higher opioid doses.[67]
Tapentadol (*Nucynta*, *Nucynta ER*): mu receptor agonist/norepinephrine reuptake inhibitor.[31]	Consider a conversion of 100 mg **tapentadol** for 30 mg morphine.[4,31] For opioid-naive patients, the starting dose of tapentadol extended-release is 50 mg twice daily (50 mg once daily in moderate liver dysfunction).[31,32] The maximum dose of tapentadol extended-release is 250 mg twice daily (100 mg once daily in moderate liver dysfunction).[31,32] The starting dose of immediate-release tapentadol is 50 to 100 mg Q4-6H (50 mg every 8 hours in moderate liver impairment).[33,38] The maximum total daily dose of immediate-release tapentadol is 600 mg (700 mg on day 1).[33,38] Not for use in severe kidney or liver dysfunction.[31-33,38]
Tramadol (e.g., *Ultram* [US], *Ralivia* [Canada], combination products with acetaminophen): weak mu receptor agonist/ weak serotonin and norepinephrine reuptake inhibitor.[1,22]	Total daily dose-equivalencies suggested vary in the literature (e.g., 10:1 [tramadol 300 mg = morphine 30 mg]; Canadian labeling, 6:1 [tramadol 400 mg = morphine 66.7 mg]).[1,37] The maximum daily dose of tramadol is 300 mg to 400 mg, depending on the product.[22,23,25-28,36,61] Also see product labeling for dosing in elderly, or in kidney or liver dysfunction. May cause withdrawal in opioid-tolerant patients.[37]
Mixed Agonist/Antagonists (pentazocine, butorphanol, nalbuphine): kappa receptor agonists or partial agonist/high affinity but poor (partial or no) efficacy at mu receptor.[40,51]	Parenteral morphine 10 mg is approximately equal to parenteral **pentazocine** 30 to 60 mg, parenteral **butorphanol** 2 mg, and parenteral **nalbuphine** 10 mg (up to a dose of 30 mg).[19,50] The analgesic efficacy of these drugs is limited by a dose ceiling.[19] Also, use is limited by kappa agonist CNS adverse effects, including dysphoria, confusion, disorientation, hallucinations.[50] May cause withdrawal in opioid-tolerant patients.[19]

Abbreviations: CNS = central nervous system; H = hour; IM = intramuscular; IV = intravenous; NA = not available; Q = every.

a. Product labeling for **hydromorphone** recommends a starting dose of 0.2 mg to 1 mg IV every two to three hours (Canadian labeling: 2 mg IM or subcutaneously [slow IV, if necessary] every four to six hours), or 2 mg to 4 mg orally (tablets) every four to six hours (one-fourth to one half-half this dose for liver or kidney impairment).[8,15,20] An even lower oral starting dose (2 mg two or three times daily) has been recommended for chronic pain in opioid-naive patients.[14] Some institutions use even lower doses of parenteral hydromorphone (e.g., 0.2 mg to 0.5 mg every two hours as needed). One regimen starts opioid-naive patients at 0.2 mg IV every two hours as needed for mild or moderate pain, with the option in moderate pain to give an extra 0.2 mg after 15 minutes if relief is inadequate after the first 0.2 mg dose. For severe pain, 0.5 mg IV every two hours as needed is used initially. In adults <65 years of age, the 0.5 mg dose can be repeated in 15 minutes if relief is inadequate, for a maximum of 1 mg in two hours.

b. Per the product labeling, convert **to *Exalgo*** 12 mg *from* oral codeine 200 mg, hydrocodone 30 mg, morphine 60 mg, oxycodone 30 mg, oxymorphone 20 mg, or transdermal fentanyl 25 mcg/hour. (These conversion doses should NOT be used when switching from *Exalgo* to another opioid.) Starting dose of *Exalgo* is 50% of the converted dose (round dose down, if necessary, to table strengths available). After the initial 50% dose reduction (for incomplete cross-tolerance), reduce dose again by 50% for moderate kidney impairment, and by 75% for moderate liver impairment. Not for use in severe liver or kidney impairment.[13]

c. Experts do not recommend long-acting products for acute, subacute, or chronic pain in opioid-naive patients.[69]

d. Start with an oral **oxymorphone** dose of 5 mg every four to six hours for opioid-naive elderly or opioid-naive patients with creatinine clearance <50 mL/min. or mild liver impairment.[44]

e. ***Kadian*** labeling: switch patients receiving any opioid other than morphine to 30 mg every 24 hours to start.[6] ***Arymo ER*** labeling: switch patients receiving any opioid other than morphine to 15 mg every eight to twelve hours.[53]

f. ***Zohydro ER.*** Conversion factors for converting **to *Zohydro ER*** are 1 for hydrocodone, methadone, or oxycodone; 2 for oxymorphone; 2.67 for hydromorphone; 0.67 for morphine; and 0.1 for codeine. Sum the current total daily dose of opioid, then multiply by the conversion factor to get the total daily *Zohydro ER* dose. Reduce by 25%. Divide Q12H. Round down. Fentanyl 25 mcg/h patch = *Zohydro ER* 10 mg Q12H. Start 18 hours after removing patch.[58] (Conversion factors should NOT be used to switch **from** *Zohydro ER* to another opioid.) ***Hysingla ER***. Conversion factors for converting **to *Hysingla ER*** are 0.15 for codeine, 4 for hydromorphone, 1.5 for methadone, 0.5 for morphine, 1 for oxycodone, 2 for oxymorphone, and 0.1 for tramadol. Reduce the calculated dose by 25% and give once daily. Patients taking other hydrocodone formulations can switch to ***Hysingla ER*** at the same total daily dose taken once daily.[62] ***Apadaz*** labeling recommends converting to *Apadaz* 6.12 mg from hydrocodone bitartrate 7.5 mg.[52]

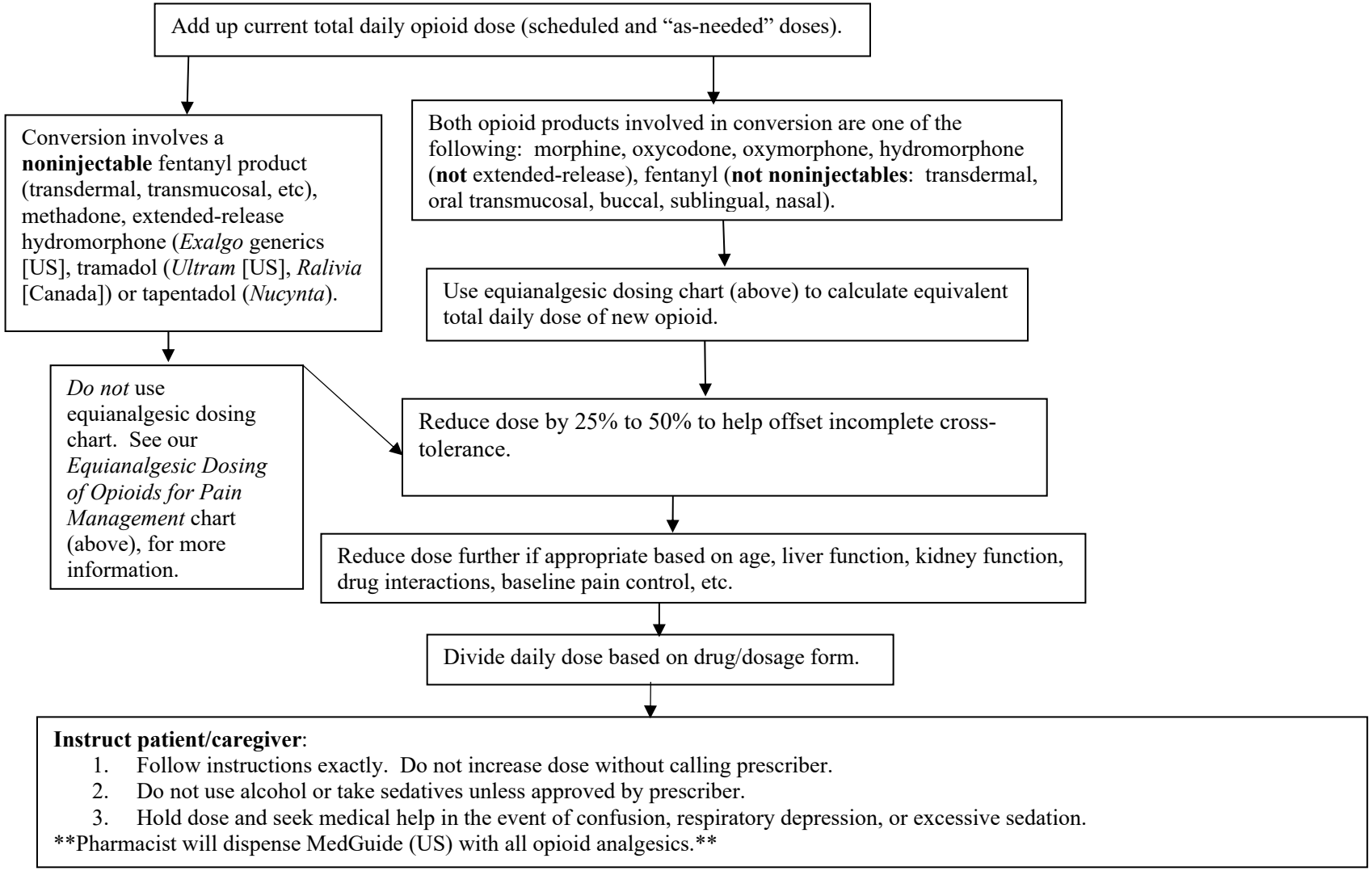
g. Examples of doses seen in clinical practice, taking into account available dosage strengths.

h. ***Xtampza ER*** labeling: switch patients receiving any opioid other than oxycodone to 9 mg Q12H.[66]

i. Per the product labeling, oral **oxymorphone ER** 10 mg is approximately equivalent to hydrocodone 20 mg or oxycodone 20 mg.[59]

Opioid Conversion Algorithm

Equianalgesic doses are approximate, and should be used only as a guide. Dosing must be titrated to individual response. Response may vary depending on tolerance, age, kidney and liver function, other conditions, drug interactions, and genetics. Also consider pain control at time of switch. Below is an algorithm for estimating opioid dose conversions.[34,36,69] Also consult product labeling for more information on switching between opioids.[69]



Example 1

Mary is a 78-year-old female with severe rheumatoid arthritis and kidney insufficiency (CrCl: 20 mL/min). She has been taking *OxyContin* 120 mg twice daily for the past six months, methotrexate, and carbamazepine. Her new insurance plan will not cover *OxyContin*, but it will cover *MS Contin*. To how much *MS Contin* should she be switched?

1. Calculate total oxycodone dose: 120 mg x 2 = 240 mg daily.
2. Convert oxycodone to morphine using equianalgesic chart:

$$\frac{\text{morphine 30 mg}}{\text{oxycodone 20 mg}} = \frac{\text{morphine X mg}}{\text{oxycodone 240 mg}}$$

X = 360 mg morphine

3. Reduce dose by 50%: 360 mg/2 = 180 mg total daily morphine dose.
   The 50% dose reduction helps account for incomplete cross tolerance, and in Mary's case, also kidney insufficiency (morphine has a metabolite eliminated by the kidneys), age, and carbamazepine use (carbamazepine reduces oxycodone levels, but not morphine levels).
4. Divide dose as appropriate based on drug/dosage form: 90 mg every 12 hours.
5. Monitor Mary's response for efficacy and adverse effects. Advise patient to hold dose and seek medical help in the event of sedation or confusion, and to seek emergency help in the event of respiratory depression.

What if Mary's prescriber had opted to switch her to *Hydromorph Contin* (Canada)?

1. Calculate total oxycodone dose: 120 mg x 2 times daily = 240 mg.
2. Convert oxycodone to hydromorphone CR using equianalgesic chart:

$$\frac{\text{hydromorphone 6 mg}}{\text{oxycodone 20 mg}} = \frac{\text{hydromorphone X mg}}{\text{oxycodone 240 mg}}$$

X = 72 mg hydromorphone

3. Reduce dose by 50% = 72 mg/2 = 36 mg hydromorphone. The 50% dose reduction helps account for incomplete cross tolerance.
4. Divide dose as appropriate based on drug/dosage form = 18 mg Q12H.
5. Monitor Mary's response for efficacy and adverse effects. Advise patient to hold dose and seek medical help in the event of sedation or confusion, and to seek emergency help in the event of respiratory depression.

Example 2

James is a 43-year-old male who has just been admitted to the rehab hospital after being released from an acute care facility for treatment of two broken legs and a broken pelvis after a motorcycle accident. He has been prescribed oxycodone 7.5 mg/acetaminophen 325 mg, two tablets every four hours as needed. He has been taking the maximum dose. The admitting prescriber is concerned about the daily amount of acetaminophen James is receiving, as he has an increased risk for liver toxicity due to a history of alcohol abuse. The prescriber would like to be able to give James an extra dose of pain medication before and/or after physical therapy if needed. He can't escalate the dose of the acetaminophen combination product due to the risk of acetaminophen toxicity. Therefore, he would like to switch James to immediate-release hydromorphone. How much hydromorphone should be prescribed for James?

1. Calculate total oxycodone dose: 7.5 mg x 2 tablets x 6 times daily = 90 mg daily.
2. Convert oxycodone to hydromorphone using equianalgesic chart:

$$\frac{\text{hydromorphone 6 to 7.5 mg}}{\text{oxycodone 20 mg}} = \frac{\text{hydromorphone X mg}}{\text{oxycodone 90 mg}}$$

X = 27 to 33.75 mg hydromorphone

3. Reduce dose by 50% = 27 mg/2 = 13.5 mg hydromorphone (OR 33.75 mg/2 = 16.875 mg). The 50% dose reduction helps account for incomplete cross tolerance.
4. Divide dose (13.5 to 17 mg) as appropriate based on drug/dosage form (rounding down): 2 mg every four hours as needed.
5. Monitor James's response for efficacy and adverse effects. Advise nurse to hold dose and call prescriber/on-call physician in the event of confusion, respiratory depression, or excessive sedation.

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