



Postmortem Case Examples Involving Oxycontin®

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Abstract

Oxycodone is a semi-synthetic opioid that is structurally similar to codeine and equipotent to morphine in producing analgesic effects. While oxycodone has been prescribed as many formulations (Percodan®, Percocet®, Tylox®, Roxicodone®, and Toxicet®), Oxycontin®, the controlled-release form, has only been available since 1996. The immediate-release oxycodone is prescribed in doses of 10-30 mg every four hours, whereas Oxycontin® is prescribed in doses of 10-160 mg every twelve hours. In a six-year period, the Los Angeles County Department of Coroner's Toxicology Laboratory detected oxycodone in fifty-eight cases, twenty-seven of which were determined to be the controlled-release form. The objective of this presentation is to provide information about Oxycontin® and to highlight case examples where numerous intact tablets were recovered from the stomach.

The isolation and identification of oxycodone from postmortem specimens was achieved with a basic, liquid-liquid extraction procedure with screening and quantitation by GC/NPD and GC/MS, respectively. D₃-oxycodone was used as an internal standard for quantitation with linearity achieved from 0.10 to 5.0 mg/L. The following table represents the tissue distribution ranges of oxycodone in the twenty-seven Oxycontin® case examples:

	Oxycodone (mg/L or mg/kg)						Gastric (mg Total)
	Heart Bld	Femoral Bld	Liver	Urine	Bile	Vitreous	
Range	0.12-46	+<0.10-5.5	0.11-6.1	2.5-122	0.19-49	0.24-0.82	0.06-119
Average	2.7	1.1	1.7	19	10	0.54	28
Number	27	20	13	19	11	4	16 (14 cases with intact pills)

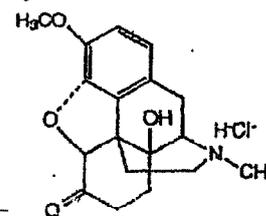
Keywords: Oxycontin®, Tissue distribution, Postmortem

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Introduction

Oxycontin® is the controlled-release form of oxycodone hydrochloride. Oxycontin® was developed by Purdue Pharma L.P. and was approved by the Food and Drug Administration in December 1995. It is prescribed in 10, 20, 40, 80, and 160 mg tablets and is indicated for the management of moderate to severe pain where the use of an opioid analgesic is required for more than a few days. The tablets are designed to provide a controlled delivery of oxycodone over a 12-hour period (1). This prolonged release is achieved using the Acro-Contin® drug delivery system. It utilizes a dual-control matrix consisting of two hydrophobic macromolecules and an acrylic polymer. Oxycodone is delivered from the tablets in a biphasic fashion with an initial rapid release of drug from the tablet surface followed by the slow release of the remainder of oxycodone by its dissolution through the tablet matrix over the 12-hour dosing period (2). The release of oxycodone from this system is pH independent and is not affected by food (1).

Oxycodone is an opioid alkaloid derived from thebaine, is structurally similar to codeine and equipotent to morphine in producing analgesic effects and is prescribed as an analgesic. Oxycodone is also available in the immediate-release form of 10-30 mg preparations and is prescribed up to four times a day. Oxycodone is well absorbed with oral bioavailability from 60 to 87%. Peak serum concentrations after a single 20-mg controlled release dose averaged 0.023 mg/L at 3.2 hours and for a 40 or 80-mg tablet averaged 0.039 and 0.099 mg/L, respectively. The absorption half-life for the immediate release form is 0.4 hours while the controlled release form has two times, 0.6 hours for the first phase and 6.9 hours for the second phase (3). Steady state concentrations are achieved within 24-36 hours after repeated dosing of normal volunteers. Oxycodone



C₁₈H₂₁NO₄ · HCl MW 351.53

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is metabolized to oxymorphone and is eliminated primarily in the urine as both the conjugated and unconjugated metabolites. The elimination half-life of the immediate release oxycodone is 3.2 hours and 4.5 hours for the controlled release form. Oxycodone is distributed to the skeletal muscle, the intestinal tract, lungs, spleen and brain (1).

Experimental Specimens

All specimens were collected at the time of autopsy. Heart blood samples were preserved in sodium fluoride. Peripheral blood samples were collected from the femoral vein and preserved in sodium fluoride and potassium oxylate. Other autopsy specimens such as liver, urine, bile, vitreous and gastric contents were stored without preservative. All liver specimens were homogenized in a blender; dry specimens were diluted (1:1, w/v) with distilled water. Gastric samples were homogenized and intact tablets were removed prior to homogenization. All specimens were stored at 4°C.

Materials

Oxycodone, courtesy of Endo Laboratories, was prepared as a 1 mg/mL stock solution in methanol. D₃-oxycodone and carbinoxamine were used as internal standards and were obtained from Cerilliant and McNeil Laboratories, respectively. The derivatizing agent, N-methyl-N-trimethylsilyltrifluoroacetamide (MSTFA) was manufactured by Sigma-Aldrich. All reagents were analytical grade and were purchased from various vendors.

Extraction

To 2 mL of standard prepared in porcine blood, blood sample, or tissue homogenate were added internal standard, 100 µL of carbinoxamine (15 mg/L) for screening or 25 µL of D₃-oxycodone (25 mg/L) for quantitation, 2 mL buffer (20% sodium carbonate), and 6 mL n-butylchloride. After rotation for 20 min and centrifugation, the organic layer was separated. Two milliliters of 0.10 N hydrochloric acid was added to the organic layer, and the sample was vortex mixed for 20 s. Following centrifugation and aspiration of the organic layer to waste, the aqueous layer was washed with 4 mL 2-methylbutane by vortex mixing for 15 s. The organic layer was aspirated to waste. The aqueous layer was made alkaline with 1 mL 20% sodium carbonate buffer and extracted with 4 mL 2-methylbutane by vortex mixing for 20 s. The organic layer was evaporated to dryness, the residue was either reconstituted with 75 µL of methanol for screening or derivatized with 50 µL MSTFA for quantitation, and transferred to autosampler vials for instrumental analysis.

Instrumentation

A Hewlett-Packard (HP) model 6890 gas chromatograph (GC) with nitrogen-phosphorus detector (NPD), with a 7683 autosampler, was used for presumptive identification. Dual column separation was achieved using two capillary columns, a HP-5 (15 m x 0.25-mm i.d., 0.25-µm film thickness) and a HP-35 (15 m x 0.32-mm i.d., 0.32-µm film thickness). The oven temperatures were programmed at 140°C for 0.50 min, increased to 300°C at 10°C/min, and held for 10.5 min (total analysis time of 27 min). The injector temperature was 260°C and the detector temperatures were 325°C.

Confirmation

Confirmation was achieved with a Hewlett-Packard model 6890 GC equipped with a 5973 mass selective detector (MSD) and 7683 autosampler. The MSD was operated in the electron impact ionization mode with a full-scan mass-to-charge ratio range of 40-450 amu. A HP-5 (15 m x 0.25-mm i.d., 0.25-µm film thickness) capillary column was used. The oven temperature was programmed at 10°C/min from 120°C to 300°C and hold for 2 minutes (total analysis time of 20 min). The injection and detection temperatures were 250°C and 300°C, respectively. The mass spectrum of oxycodone showed a base peak of *m/z* 315 and other significant peaks at *m/z* 230, 115 and 201.

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Quantitation

Quantitation was achieved using a MSD utilizing a HP-5 column with the oven temperature programmed at 10°C/min from 200°C to 300°C. The injection and detection temperatures were 250 and 300 C, respectively. The ions used for quantitation were 387, 372, and 388 for oxycodone (derivitized) and 390, 375, and 391 for D3-oxycodone (derivitized).

Results

Tissue specimens were collected during autopsy and submitted for routine toxicology testing. The time interval between death and autopsy varied from 24-72 hours. Heart blood samples were tested for volatiles by headspace GC, screened for drugs of abuse by radioimmunoassay or ELISA, and for pharmaceutical drugs by GC/NPD. Oxycodone was presumptively identified from a basic extraction by GC/NPD and confirmed by GC/MS. Quantitation of oxycodone was by GC/MS performed on a second aliquot of specimen. Assay linearity was 0.10-5.0 mg/L. Case histories, postmortem oxycodone (Oxycontin[®]) tissue distributions, and the cause and manner of death for 27 cases are detailed in the table.

Summary

Although oxycodone has been around since 1917, the controlled release formula, Oxycontin[®], is relatively new and has just recently gained notoriety as a drug of abuse (4). Since 1996, the Los Angeles County Department of Coroner's Toxicology Laboratory detected Oxycontin[®] in 27 cases, 15 in the last two years. For summary purposes, the 27 cases have been organized by the mode of death. There were 14 cases coded as accidental deaths, 9 suicides, 2 naturals, and 2 undetermined deaths. The 15 accidental deaths had oxycodone heart blood levels that ranged from 0.12-2.7 mg/L, and femoral blood levels that ranged from <0.10-2.2 mg/L. The 9 suicides had a heart blood range of 0.56-46 mg/L, and a femoral blood range of 0.59-5.5 mg/L. The 2 natural deaths had blood levels of 0.69 and 1.0 mg/L, and the 2 undetermined cases had oxycodone heart blood levels of 0.27 and 1.3 mg/L. A review of the 27 cases brings to light some interesting issues with this dual matrix, controlled-release system.

Discussion

The authors first took notice of Oxycontin[®] because cases involving the drug had numerous intact tablets found in the stomach at autopsy. Intact tablets were found in 14 of the 27 cases studied. The Los Angeles County Department of Coroner's Toxicology Laboratory frequently interprets cases with intact tablets or residue in the stomach coupled with lethal blood levels of that drug to be suicides. This may not necessarily be the case with Oxycontin[®].

According to Purdue Pharma L.P., the co-polymer wax matrix of Oxycontin[®] is not meant to dissolve. A small amount of oxycodone is immediately released as the outside layer surrounding the matrix dissolves after ingestion (2). The majority or remainder of the oxycodone in the tablet leaches out of the matrix and is delivered over a 12-hour period, leaving behind an intact, drug-free wax matrix referred to as "ghost pills" (5). In most of the cases studied, these intact "ghost pills" were clearly marked with an "OC" on one side and a number indicating dose on the other. An analysis of some of the recovered Oxycontin[®] tablets from the stomach of several cases revealed little or no oxycodone, supporting the theory that the intact tablets are actually "ghost pills."

In 14 of the 27 cases studied, an additional opiate was detected in the heart blood. Of the 14 multiple opiate cases, 8 had intact tablets recovered from the stomach. The authors postulate that because opiates cause a decrease in gastric motility, this effect may lead to a build-up of oxycodone in the stomach and a decreased ability to clear the tablets. The authors also suggest that because Oxycontin[®] is a controlled-release tablet, the drug will continue to leach out of the tablet after death, which may lead to a falsely elevated stomach concentration. However, in the cases studied, the gastric concentration of oxycodone was considerably less than expected in comparison to the remaining tablets. This suggests that oxycodone is being cleared from the stomach, antemortem, while empty "ghost pills" remain. Although

the death may still be an oxycodone overdose, intact tablets in the stomach may not necessarily indicate a suicide.

The authors can only speculate as to why an increased number of tablets were discovered in the stomach of so many of the cases presented. Perhaps, individuals may be accustomed to taking multiple doses of another type of pain medication or they may be used to immediate pain relief upon dosing and take more Oxycontin[®] when the initial analgesia appears less than effective. There is some concern that those taking Oxycontin[®] are not educated about the controlled release system of drug delivery. Another interesting fact noted while evaluating the case histories was the apparent over prescribing of Oxycontin[®]. Despite the manufacturer's recommendation that dosing should occur over a 12-hour period, in many of the 27 cases, prescriptions were found for the administration of Oxycontin[®] 3, 4 and even 6 times a day. Again, the lack of understanding about this controlled release delivery system may be a reason for the recovery of so many intact tablets from the stomach. Of course, the possibility that individuals may have taken an intentional overdose of Oxycontin[®] in a suicidal gesture cannot be ruled out.

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SUICIDE DEATHS											
Case No.	Case History	Prescribed Oxycodone & Directions (taken/remaining)	Oxycodone (mg/L or mg/kg)						Gastric (mg total)	Other Drugs Detected Heart Blood (mg/L)	Cause of Death
			Heart Blood	Femoral Blood	Liver	Urine	Bile	Vitreous			
1	40-year old male (height 70", weight 85 kg) found unresponsive on floor of residence. History of a job related back injury, multiple corrective surgeries, and an addiction to prescription medications and street drugs. Prior suicide threats. Medications prescribed: Lorazepam, diltiazem, carbisoprodol, propranolol, and hydrocodone.	2/4/98 240/171 10-mg 1 tab 4x/day Date of Death 2/6/98	0.56	---	---	---	---	---	---	Benzoylceponine 0.31 Carisoprodol 8.7, Meprobamate 20	Multiple Drug Intoxication
2	50-year old male (73", 114 kg) with a history (14-year ago) of cocaine and ethanol abuse, was found unresponsive in his secured residence. He was a healthy, body building individual and suffered occasional migraine headaches. Medications recovered from the scene included oxycodone, aripiprazole, verapamil, and sildenafil.	20-mg Date of Death 9/11/99	0.58	1.1	---	---	---	0.04 37 intact tablets	No other drugs detected	Oxycodone Intoxication	
3	45-year old male (75", 87 kg) disabled in a car crash, was found in a motel room. History of depression, constant pain, prescription drug abuse, and suicidal ideations. Prescribed clonazepam, olanzapine, paroxetine, and oxycodone.	6/4/01 140/0 10-mg 1 tab 2x/day Date of Death 6/20/01	0.75	QNS	5.8	22	5.0	0.51 115 50 intact 10-mg tablets	Olanzapine 0.76 Carbamazepine 8.1	Multiple Drug Intoxication	
4	50-year old female (62", 70 kg) with a history of osteoporosis, fractures of the spine, and was semi-ambulatory. Found unresponsive at her residence with the following medications: hydrocodone, zolpidem, venlafaxine, disizepam, and tramadol.	2/6/97 60/14 20-mg 1-2 tabs q day Date of Death 3/24/97	0.82	0.59	0.57	5.4	---	0.82 13 35 intact 20-mg tablets	Diphenhydramine 0.75 Hydrocodone 0.20 Venlafaxine 0.30 Zolpidem 5.0	Acute Ingestion of Multiple Oral Medications	
5	31-year old male (72", 75 kg) resident physician with a history of depression. He was found unresponsive in his residence with an 8-page detailed suicide note stating he had crushed oxycodone and placed it into capsules.	Not Indicated Date of Death 4/18/01	0.91	0.98	2.0	32	11	---	0.52 2 intact tablets	Citalopram 0.32, Norelthopram 0.21, Propoxyphene 0.57, Nisipropoxyphene 0.62, Venlafaxine 0.40, Lithium 1.93 Meq/L	Multiple Drug Intoxication
6	37-year old male (69", 63 kg) with history of suicide was found unresponsive inside of a canvas covered parked car, with a hose apparatus leading from the exhaust pipe to inside the car. The keys were on the passenger seat. The decedent abused ethanol and prescription medications and had regular visits to mental health professionals. Twenty bottles of medications were recovered from the dashboard of the vehicle: oxycodone, buspirone, fluoxetine, thioridazine, hydroxychloroquine, amitriptyline, flurazepam, carisoprodol, naproxen, and hydrocodone.	9/1/99 60/6 20-mg 1 tab 2x/day Date of Death 10/3/99	1.4	QNS	---	---	---	---	16 9 intact tablets & 4 pill fragments	Fluoxetine 2.3, Nortriptyline 1.4 Amitriptyline 0.44, Nortriptyline 0.50	Multiple Drug Intoxication
7	50-year old female (63", 104 kg) found unresponsive in bed at her residence with a suicide note. History of back pain, depression, and domestic problems. Prior to her death, her Doctor noticed that she was lethargic and advised her to decrease her dose of oxycodone. Medications included butalbital, paroxetine, trazodone, flurazepam, and hydroxyzine.	10/9/98 60/0 40-mg 1 tab q 12 hours Date of Death 10/18/98	1.8	3.0	---	---	---	---	8.9	Ethanol 0.02 G%	Acute Oxycodone Intoxication
8	47-year old female (62", 89 kg) with a history of pain, foot amputation, and cerebral aneurysm, was found unresponsive in her residence. A suicide note was recovered stating she was depressed over medical and personal problems. Medication bottles collected from her nightstand included: oxycodone, amitriptyline, hydrocodone, and carbamazepine.	6/25/01 60/31 20-mg 1 tab 2x/day Date of Death 7/4/01	5.4	1.4	6.1	2.5	49	---	119 39 intact 20-mg tablets	Hydrocodone 0.33 Carbamazepine 7.9 Amitriptyline 0.15 Nortriptyline <0.10	Multiple Drug Intoxication
9	35-year old male (72", 80 kg) with a history of constant pain (nerve damage) was found hanging in a bedroom doorway in his residence. A suicide note was found. Medications prescribed included paroxetine and oxycodone.	8/14/00 120/0 40-mg 1 tab 4x/day 7/21/00 120/0 40-mg 4x/day 5/30/00 120/0 40-mg 1 tab 4x/day 9/13/99 120/0 40-mg 1 tab 4x/day Date of Death 8/24/00	46	5.5	---	---	---	---	---	Cocaine 0.23, Benzoylceponine 2.5 Morphine 2.1, Codeine 0.16, 6-MAM + Hydrocodone 0.14	Hanging

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ACCIDENTAL DEATHS												
Case No.	Case History	Prescribed Oxycodone & Directions (Issued/Remaining)	Oxycodone (mg/L or mg/kg)							Gastric (mg total)	Other Drugs Detected Heart Blood (ng/L)	Cause of Death
			Heart Blood	Femoral Blood	Liver	Urine	Bile	Vitreous				
10	51-year old female (height 66", weight 73 kg) with numerous medical problems including hospital stays for pain related problems, back surgery, depression, edema, ulcers, GI bleeding, and rheumatic fever as child. She was angry at her physician for cutting back on her pain medications, was seeing a psychologist and was known for taking fluids of medications. The decedent was found unresponsive on couch. Medications included oxycodone, methadone, bupropion, gabapentin, fluoxetine, hydrocodone, clonazepam, and diazepam.	2/28/00 120/0 40-mg 2 tabs Q 8 hours 9/26/00 90/0 40-mg 1 tab 3x/day 10/24/00 90/0 40-mg 1-3 tabs daily 11/2/00 360/0 20-mg 4 tabs Q 8 hours 12/7/00 42/0 20-mg 3 tabs Q 8 hours	0.12	0.35	0.11	7.3	0.19	0.24	3.9 3 intact 20-mg tablets	Methadone 0.87	Effects of acute and chronic narcotic addiction	
11	47-year old female (66", 45 kg) was taking medications for her broken arm that were prescribed by her M.D. husband. She suffered from depression (no suicidal ideations) and she was found unresponsive in bed of her residence. Medications included valproic acid, trazodone, diazepam, and hydrocodone.	Not indicated	0.13	<0.10	--	3.2	--	--	0.06 8 intact tablets	Citalopram 0.49, Nortriptyline 0.19 Methadone 0.29, Trazodone 0.15 Diazepam 0.49, Nortriptyline 1.4	Multiple Drug Intoxication	
12	66-year old female (64", 71 kg) with a history of breast cancer, heart disease, and dizzy spells. Found unresponsive outside her front door with trauma to the back of her head. Her purse and a bag of groceries were lying beside her. The following medications were prescribed: oxycodone, acetaminophen with codeine, doxepin, and verapamil.	20-mg 3 tabs Q 4 hours 20-mg 2 tabs Q 8 hours	0.18	0.44	--	--	--	--	Not quantitated Autopsy report states 10 intact 20-mg tablets	Codeine 0.35, Verapamil +0.10 Doxepin 0.29, Nortriptyline +0.10	Adrenocortical coronary heart disease, metastatic breast carcinoma, oxycodone effect	
13	50-year female (66", 48 kg) was found unresponsive on the couch with coffee ground emesis purging from mouth. History of fiber myalgia and thought to have abused prescription drugs. Medications collected from the scene were oxycodone, carboprostol, clonazepam, diazepam, and trazodone.	4/5/01 90/0 40-mg 1 tab 3x/day	0.24	QNS	0.23	6.9	2.7	--	2.5	Methamphetamine 0.41, Amphetamine 0.03 Diphenhydramine +<0.50, Hydrocodone 0.64 Carisoprodol 23, Meprobamate 32	Multiple Drug Effects	
14	49-year old female (64", 64 kg) with a history of breast cancer, severe backpain and depression was found unresponsive in bed. Loose pills including oxycodone, acetaminophen, diazepam, diphenhydramine, fluoxetine, hydrocodone, ibuprofen, methocarbamol, paroxetine, propoxyphene, pseudoephedrine, salicylate, temazepam, and zolpidem were found next to the decedent.	Not indicated	0.39	0.38	0.40	21	1.3	--	1.6	Diphenhydramine 0.38, Fluoxetine 0.14 Paroxetine 0.18, Fentanyl 0.011 Propoxyphene 0.91, Nortriptyline 9.7	Poly-medication Overdose	
15	42-year old male (70", 86 kg) was found unresponsive on couch with purge emitting from his mouth. History of a knee injury with medications prescribed to control the pain. Empty vials of medication were recovered at scene, hydrocodone and diazepam. Other medications included clonazepam, gabapentin, and oxycodone.	9/7/99 190/36 10-mg 3 tabs-3x/day	0.57	0.25	--	Present	--	--	--	Codeine 0.04	Obstructive Coronary Atherosclerotic Disease	
16	34-year old male (71", 66 kg) who suffered constant pain from a back injury, was found unresponsive in bed. On one previous occasion, decedent accidentally overmedicated himself. Medications prescribed were oxycodone, methocarbamol, trazodone, dicyclanide, diazepam, alprazolam, metoprolol, nortriptyline, zolpidem, clonidine, carisoprodol, and bupropion.	9/14/00 150/141 40-mg 3 tabs am & 3 tabs pm	0.69	1.1	0.45	8.0	3.9	--	3.3	Mirtazapine 0.16, Zolpidem +<0.10 Diazepam 0.11, Nortriptyline 0.15 Carisoprodol +<2.5, Meprobamate 9.6 Methocarbamol +<10	Multiple Drug Effects	
17	41-year old male (height 70", weight 93 kg) with a history of allergies, migraines, depression, back pain and head injuries from a motorcycle accident.	40-mg tablets	0.83	0.57	--	--	--	--	--	Butalbital +<0.50 Promethazine 0.60 Codeine 0.06 Hydrocodone 0.06	Multiple Drug Intoxication	
18	25-year old male (67", 95 kg) found unresponsive at home with many prescription medications. History of back injury from a car accident, depression and medication abuse. Parents questioned the large amount of medications prescribed by his doctor. Amitriptyline, alprazolam, fluoxetine, cyclobenzaprine, and nefazodone.	5/29/98 60/0 20-mg 2 tabs-2x/day 8/26/98 90/54 20-mg 3 tabs-2x/day	0.87	--	--	--	--	--	--	Amitriptyline 0.87, Nortriptyline 0.25 Cyclobenzaprine 0.23, Fluoxetine 0.05 Nefazodone 0.09 Trazodone 0.11	Multiple Drug Intoxication	

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ACCIDENTAL DEATHS		Oxycodone (mg/L or mg/kg)								Other Drugs Detected	Cause of Death
Case No.	Case History	Prescribed Oxycodone & Directions (issued/remaining)	Heart Blood	Femoral Blood	Liver	Urine	Bile	Vitreous	Gastric (mg total)	Heart Blood (mg/L)	
19	34-year old male (height 70", weight 86 kg) with a history of prior suicide attempts and depression over medical problems was found unresponsive on his couch by a roommate. Prescription medications include oxycodone, clonazepam, gabapentin, metoprolol, clonazepam, methylphenidate, and olanzapine.	40-mg Date of Death 11/8/00	0.95	2.2	1.4	122	3.9	---	12 1 intact 40-mg tablet	Dextromethorphan 0.21 Doxylamine 0.24 Hydrocodone 0.07	Acute Multiple Medicinal Drug Intoxication
20	37-year old female (64", 120 kg) who was a paraplegic as a result of a traffic accident, was found unresponsive in bed. She had a history of depression and suicidal ideations. She took her mother's prescription medication (Oxycodone 2-80 mg tablets) the night before her death.	Not indicated Date of Death 10/12/00	1.2	1.5	1.6	---	23	0.25	---	No other drugs detected	Pneumonia, Oxycodone Toxicity
21	44-year old female (64", 90 kg) with a history of depression, fatigue, and a sleep disorder was found unresponsive in bed of residence. She spoke of suicide but said, "It was morally wrong and that Christians did not exhibit that sort of behavior." The decedent had a habit of overdosing on narcotic prescription medications. Medications recovered at scene included oxycodone, propranolol, risperidone, clonazepam, gabapentin, chlorpromazine, venlafaxine, hydrocodone, propoxyphene, carisoprodol, quetiapine, and zolpidem.	2/20/00 180/106 40-mg 2-3 tabs Q12 hour Date of Death 7/27/00	1.7	1.5	0.53	QNS	6.4	---	~45 4 intact tablets	Diphenhydramine 0.16 Promethazine +<0.10 Venlafaxine 3.3, Gabapentin 33 Risperidone 0.026	Multiple Drug Intoxication
22	50-year old female (61", 52 kg) with a history of lupus and constant pain was found unresponsive in bed. Prescription medications on the nightstand included oxycodone, tramadol, butalbital, tramazepam, diazepam, sertraline, and paroxetine.	6/26/00 270/0 40-mg 2-3 tabs Q 8 hrs 7/24/00 270/0 40-mg 2-3 tabs Q 8 hrs 8/21/00 270/262 40-mg 2-3 tabs Q 8 hrs Date of Death 8/22/01	1.9	0.66	1.9	8.8	3.6	---	28 40-mg tablet recovered from Duodenum	Butalbital 9.8 Diphenhydramine 0.28 Sertraline 0.47, Nortriptyline 1.0 Tramadol 0.08	Probable combined effects of coronary atherosclerosis and medication excess.
23	44-year old male (73", 75 kg) was found unresponsive in bed. He had a history of insulin dependency, depression with suicidal ideations, and suffered back pain.	Not indicated Date of Death 8/1/98	2.7	0.23	---	2.3	---	---	Autopsy report states 8 intact 20-mg tablets	Ethanol 0.13 G% Nefazodone 0.50, Orphenadrine 1.4 Benzylalgonine 0.09 Hydrocodone 0.38	Polymedication Use

NATURAL DEATHS		Oxycodone (mg/L or mg/kg)								Other Drugs Detected	Cause of Death
Case No.	Case History	Prescribed Oxycodone & Directions (issued/remaining)	Heart Blood	Femoral Blood	Liver	Urine	Bile	Vitreous	Gastric (mg total)	Heart Blood (mg/L)	
24	41-year old female (height 62", weight 36 kg) with a history of back pain and flu-like symptoms was found unresponsive on the floor of her residence. Medications recovered included nortriptyline, diphenhydramine, valproic acid, paroxetine, and nadolol.	3/6/98 100/38 40-mg 1 tab 4x/day Date of Death 3/19/98	0.69	---	---	---	---	---	---	Nadolol 0.33 Valproic acid 16 Diazepam 0.29, Nordiazepam 1.4 Mirtazapine 0.28 Paroxetine 0.13 Prochlorperazine +<0.10	Acute Cardiac Dysfunction
25	40-year old disabled male (71", 142 kg) with degenerative cervical disease was found unresponsive on the couch of his residence. He had a history of overmedicating himself.	6/24/96 180/0 40-mg 3 tabs Q 12 hours Date of Death 9/25/96	1.0	---	---	---	---	---	---	Diazepam 0.77, Nordiazepam 2.1 Codeine 1.4, Morphine 0.09	Dilated Cardiomyopathy

UNDETERMINED DEATHS		Oxycodone (mg/L or mg/kg)								Other Drugs Detected	Cause of Death
Case No.	Case History	Prescribed Oxycodone & Directions	Heart Blood	Femoral Blood	Liver	Urine	Bile	Vitreous	Gastric (mg total)	Heart Blood (mg/L)	
26	45-year old female (height 65", weight 78 kg) found unresponsive in bed by family. She had a history of back injuries, migraines, and depression. Medications prescribed included tramadol, zolpidem, meperidol, bupropion, lithium, paroxetine, and fluoxetine.	Not indicated	0.27	---	---	---	---	0.32	---	Fluoxetine 0.16, Nortriptyline 0.34 Zolpidem +<0.10 Tramadol 0.08 Nordololcyclizine 0.10	Cardiomyopathy
27	62-year old male (70", 105 kg) with a history of depression, migraines, colostomy and diverticulitis. The decedent was under the treatment of a psychiatrist who stated he did not have suicidal ideations. Medications prescribed included oxycodone, desipramine, and doxepin.	7/3/01 30/8 40-mg 1 tab 2-3x/day Date of Death 7/4/01	1.3	1.0	1.5	4.7	---	---	78 17 intact 40-mg tablets	Hydrocodone 0.05 Desipramine 0.64 Doxepin 0.17, Nordoxepin +<0.10	Multiple Drug Intoxication