Anesthesia for Addict Patients

An Essay

Submitted for Partial Fulfillment of Master Degree
in Anesthesiology

By

Eisa Muhammad Atyya

M.B., B.Ch., (2006)
Ain Shams University

Under Supervision of

Prof. Dr. Ayman Mokhtar Kamaly

Professor of Anesthesiology, Intensive Care & Pain Management
Faculty of Medicine – Ain Shams University

Prof. Dr. Ahmed Nagah Elshaer

Professor of Anesthesiology, Intensive Care & Pain Management
Faculty of Medicine – Ain Shams University

Dr. Assem Adel Moharram

Lecturer of Anesthesiology, Intensive Care & Pain Management
Faculty of Medicine – Ain Shams University

Faculty of Medicine
Ain-Shams University

2014

بِسْمِ اللّهِ الرّحمَنِ الرّحيمِ

[...رَبِّ اَوزِعنِي اَن اَشكُرَ نِعمَتَكَ
الّتِي اَنعَمْتَ عَلَيَّ و عَلى والِدَيَّ
و اَنْ اَعْمَلَ صَالِحاً تَرْضَاهُ و اَدْخِلْنِي
بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ]

صدق الله العظيم

النمل.. اية رقم ١٩

Acknowledgements

*First, and foremost, my deepest gratitude and thanks should be offered to **"ALLAH"**, the Most Kind and Most Merciful, for giving me the strength to complete this work.*

*I would like to express my sincere gratitude to **Prof. Dr. Ayman Mokhtar Kamaly,** Professor of Anesthesiology, Intensive Care & Algology, Faculty of Medicine – Ain Shams University, for his continuous support and guidance for me to present this work. It really has been an honor to work under his generous supervision.*

*I acknowledge with much gratitude to **Prof. Dr. Ahmed Nagah Elshaer,** Professor of Anesthesiology, Intensive care & Algology, Faculty of Medicine – Ain Shams University, for his great supervision and unlimited help to provide all facilities to accomplish this work.*

*I acknowledge with much gratitude to **Dr. Assem Adel Moharram,** Lecturer of Anesthesiology, Intensive care & Algology, Faculty of Medicine – Ain Shams University, for his great efforts and time he has devoted to accomplish this work.*

*Last but not least, thanks to **my Parents**, **my Wife** and **Children** for helping me to finish this work.*

Eisa Muhammad Atyya

العلم يرفع بيوتاً لا عماد لها

والجهل يهدم بيت العز والكرم.

أبو العلاء المعرى

Contents

List of Abbreviations

ACTH : Adrenocorticotropic hormone

AIDS : Acquired immunedeficiency syndrome

ARDS : Acute respiratory distress syndrome

AV : Atrioventricular

CNS : Central nervous system

CPA : Canadian Pharmacists Association

CTZ : Chemoreceptor trigger zone

DOP : Delta opioid receptor

EEG : Electroencephalogram

HIV : Human immunodeficiency virus

ICU : Intensive care unit

IUPHAR : International Union of Pharmacology

KOP : Kappa opioid receptor

LSD : Lysergic acid diethylamide

M6G : Morphine 6-glucuronide

MAC : Minimal alveolar concentration

MDMA : Methylenedioxy-methamphetamine

MNTX : Methylnaltrexone

MOP : Mu opioid receptor

N/OFQ : Nociceptin/orphanin FQ

NIDA : National Institute of Drug Abuse

NMDA : N-methyl-D-aspartate

OBD : Opioid bowel dysfunction

List of Abbreviations *(Cont...)*

OGFr : Opioid Growth Factor Receptor

PCP : Phencyclidine

POMC : Proopiomelanocortin

RR : Respiratory rate

RVLM : Rostral ventrolateral medulla

SA : Sinoatrial

SSTRs : Somatostatin receptors

THC : Tetrahydrocannabinol

VT : Tidal volume

Introduction

Through the years, abuse of illicit substances has been escalating despite efforts in health education, prevention and different detoxification or rehabilitation treatment approaches. This is illustrated by the fact that in 2003 an estimated 19.5 million Americans (8.2% of the population) of ages 12 and older were current users of illicit drugs ***(US Department of Heath and Human Services, 2003).***

Even though as anesthesiologists we are generally not the primary care physicians of these patients, we encounter these patients as we administer anesthesia to them for emergency or trauma situations, obstetrics and even for regular elective surgeries ***(Demetriades et al., 2004).***

Although a history may not be forthcoming initially, clearly the type and pattern of use is important as patients may have developed tolerance or dependence with chronic use or may be acutely intoxicated. This has a bearing on their physiology, psychology, and changes in pharmacodynamics and pharmacokinetics. In addition to adverse effects directly related to the pharmacology of each drug of abuse, users may also suffer ill health arising from the circumstances of use. These include complications arising from the route of abuse and those associated with malnutrition and lifestyle (e.g. tuberculosis) ***(Statistics on Drug Misuse: England, 2007).***

The route of administration of the most addictive drugs is often parenteral. Inhalation and i.v. routes are often used which minimize onset time and first-pass metabolism. I.V. injection can be the cause of infections, including local abscess formation and infective endocarditis which usually involves the right side of the heart. Venous thrombosis is a common complication of i.v. drug abuse and this may make vascular access difficult, particularly in chronic abusers. Inhalation induction of anesthesia or central venous access may be required if peripheral veins have thrombosed. If this is the case, then the central line should be removed as soon as the patient is ambulant or unsupervised to minimize the risk of air embolism, infection, or overdose if the venous catheter is abused ***(Wojtowicz et al., 2008).***

It is important to remember that patients using illicit substances are frequently undermedicated for pain since they may require higher and more frequent doses of analgesics to achieve expected effects, especially since most have cross-tolerance to opioid analgesics ***(Kak and Chandrasekar, 2002).***

Drug addiction is a chronically relapsing disorder characterized by compulsion to seek and take drug(s) regardless of the adverse consequences that may ensue. Prescription opioid analgesic abuse is the fastest growing form of drug abuse in the US. Abused prescription opioids include hydrocodone (Vicodin, Lortab), oxycodone (Percocet,

OxyContin), hydromorphone (Dilaudid), fentanyl (Duragesic, Fentora), and others ***(Biondo and Chilcoat, 2013).***

The fourth environmental hypothesis, propose that"second-hand" exposure may produce changes in the brain that predispose susceptible anesthesia providers to chemical dependence. They have detected propofol and fentanyl in air sampled from cardiac surgery operating rooms. The highest concentrations were in samples from air around the patient's head ***(Gold et al., 2006).***

Five families of endogenous opioid peptides bind to the various opioid receptors. The peptides show some binding selectivity, but there is no consistent association between a peptide family and a particular receptor mechanism. Four of the families begin as large polypeptide molecules that are subsequently cleaved to yield several opioid (and some nonopioid) peptides. Although some of these peptides undoubtedly function in nociceptive pathways, they also appear to play fundamental roles in processes like thermoregulation and hormone release, as well as gastrointestinal and cardiovascular control ***(Mogil and Pasternak, 2001).***

Aim of the Work

The aim of this work is to discuss the most common illicit drugs being used, to know their side effects and clinical presentation if abused or intoxicated, and to know what anesthetic options would be beneficial or deterimental.

Chapter (1)
Pathophysiology of Addiction

Drugs such as cannabis, opium, and cocaine have been cultivated and used medicinally as well as recreationally for centuries. Opium poppies are believed to have been first grown in the region near modern-day Iraq as early as 3400 B.C. Opium was used primarily as an analgesic and anesthetic, but medical use did not become widespread until the development of the hypodermic needle in the early 1800s ***(Musto et al., 2002).***

Historical analysis also indicates that marijuana was smoked recreationally and medically in ancient China as early as 2737 B.C. (***Musto et al., 2002)***.

In South America, societies have grown and consumed coca, the plant grown to create cocaine, for centuries. The most common mode of administration is to chew the leaves of the coca plant, or to mix the leaves into a tea ***(Streatfeild, 2002).***

Morphine is believed to have been prescribed often in the nineteenth and early twentieth centuries mainly as a cough suppressant to ease the suffering of individuals with tuberculosis ***(Musto et al., 2002).***

During the Civil War, it is believed that more than 400, 000 soldiers became dependent on morphine, as it was

liberally prescribed for pain associated battle wounds ***(Musto et al., 2002).***

More systematic surveys of United States drug use began in the 1960s. A series of national household surveys on drug use conducted by the National Institute on Drug Abuse and later by the Substance Abuse and Mental Health Services Administration showed that illicit drug use, especially marijuana, increased greatly after the late 1960s. Heroin use also increased in the late 1960s, when the profile of users changed from "bohemians" to inner-city, unemployed males ***(Johnston et al., 2003).***

National Institute on Drug Abuse, since 1975 indicate that 50% of 12th-grade students have used an illicit drug, with a high of 66% in 1982, a low rate of 41% in 1992, and 51% in 2004. Since 1975, over 80% of students felt that marijuana was easily available, ranging from 82.7% in 1992 to 90.4% in 1998. The most commonly used illicit opioid is heroin, with over 2 million users in the US ***(Biondo and Chilcoat, 2013).***

A survey of school children in Great Britain showed that 15.8% of boys have been offered the drug Ecstacy and that 5.7% have taken it. A survey among school children revealed that, frequently used drugs are marijuana (59%), amphetamines (19%), cocaine (18%), and LSD (18%) ***(Christophersen, 2000).***

Prescription opioid analgesic abuse is the fastest growing form of drug abuse in the US.Abused prescription opioids

include hydrocodone (Vicodin, Lortab), oxycodone (Percocet, OxyContin), hydromorphone (Dilaudid), fentanyl (Duragesic, Fentora), and others ***(Biondo and Chilcoat, 2013).***

ADDICTION: DEFINITIONS AND NEUROBIOLOGY

Drug addiction is a chronically relapsing disorder characterized by compulsion to seek and take drug(s) regardless of the adverse consequences that may ensue ***(Gardner, 2005).***

Addiction develops as a result of interactions between the availability, cost, and pharmacology of a drug of abuse, environmental and psychosocial factors (e.g., occupation, peer group), genetic predisposition, comorbid psychiatric disorders, and drug exposure. Addiction has a highly variable clinical course. Initial drug use is voluntary behavior, and most users do not develop drug-dependence. However, repetitive drug exposure in a susceptible individual appears to cause fundamental changes in central nervous system function that produce the disease. Experimental evidence suggests that genetic predisposition to addiction may be related to alterations in neurocircuitry that enhance sensitivity to the reinforcing effects of drugs of abuse, thus overwhelming cognitive control of behavior ***(Nestler, 2001).***

Addicts typically exhibit decreased motivation for natural rewards (e.g., food, water, sex) that normally drive behavior.

The abrupt cessation of drug use leads to the emergence of both affective (e.g., dysphoria, anxiety, anhedonia) and somatic withdrawal signs ***(Everitt and Wolf, 2002).***

However, the application of a systems approach to the study of addiction has provided new insights as to the role of brain regions comprising the limbic cortical-striatopallidal circuit in mediating the dysregulation of behavior that characterizes addiction ***(Everitt and Wolf, 2002).***

A patient may enter recovery with abstinence and treatment, but once present, addictive disease is regarded as permanent. However, addiction may be managed successfully as a chronic disease, and many patients respond positively to treatment with long periods of abstinence ***(McLellan et al., 2000).***

The neurobiology of addiction is summarized in three concepts that have immediate bearing on the anesthesiologist caring for the patient with addiction: uniform drug reward and reinforcement, cross-addiction, and disease permanence. The mesocorticolimbic dopamine system is central to the pathophysiology of addiction ***(Gardner, 2005.)***

This neurocircuitry involves the ventral tegmental area of the midbrain where dopaminergic neurons originate and the basal forebrain, the nucleus accumbens, and the amygdala to which these neurons project. All drugs abused by humans have