Medical Marijuana Program

165 Capitol Avenue, Room 145, Hartford, CT 06106-1630 • (860) 713-6066
E-mail: dcp.mmp@ct.gov • **Website:** www.ct.gov/dcp/mmp

Petition to Add a Medical Condition, Medical Treatment or Disease to the List of Debilitating Conditions

INSTRUCTIONS: Please complete each section of this Petition and attach all supportive documents. All attachments must include a title referencing the Section letter to which it responds. Any Petition that is not fully or properly completed will not be submitted to the Board of Physicians.

Please Note: Any individually identifiable health information contained in a Petition shall be confidential and shall not be subject to disclosure under the Freedom of Information Act, as defined in section 1-200, Connecticut General Statutes.

Section A: Petitioner's Information

Name (First, Middle, Last): [redacted]		
Home Address (including Apartment or Suite #): [redacted]		
City: [redacted]	State: CT	Zip Code: [redacted]
Telephone Number: [redacted]	E-mail Address: [redacted]	

Section B: Medical Condition, Medical Treatment or Disease

Please specify the medical condition, medical treatment or disease that you are seeking to add to the list of debilitating medical conditions under the Act. Be as precise as possible in identifying the condition, treatment or disease. SEE SECTIONS A and F. And yellow highlights of sections C, D, E, I

Section C: Background

Provide information evidencing the extent to which the condition, treatment or disease is generally accepted by the medical community and other experts as a valid, existing medical condition, medical treatment or disease.

- Attach a comprehensive definition from a recognized medical source.
- Attach additional pages as needed.

SEE SECTIONS A AND F. Also, yellow highlighted parts of SECTIONS C, D, E, I

Section D: Negative Effects of Current Treatment

If you claim a treatment, that has been prescribed for your condition causes you to suffer (i.e. severe or chronic pain, spasticity, etc.), provide information regarding the extent to which such treatment is generally accepted by the medical community and other experts as a valid treatment for your debilitating condition.

- Attach additional pages as necessary.
- If not applicable, please indicate N/A.

N/A

Section E: Negative Effects of Condition or Treatment

Provide information regarding the extent to which the condition or the treatments thereof cause severe or chronic pain, severe nausea, spasticity or otherwise substantially limits one or more major life activities.

- Attach additional pages as necessary.

SEE Section O, J, K, L, M, N

Section F: Conventional Therapies

Provide information regarding the availability of conventional medical therapies, other than those that cause suffering, to alleviate suffering caused by the condition or the treatment thereof.

- Attach additional pages as necessary.

SEE Section J, K, L

Section G: General Evidence of Support for Medical Marijuana Treatment

Provide evidence, generally accepted among the medical community and other experts, that supports a finding that the use of marijuana alleviates suffering caused by the condition or the treatment thereof.

- Attach additional pages as necessary.

SEE Sections B, G, H, AND Green Highlighted sections C, E, D, F, & I

Section H: Scientific Evidence of Support for Medical Marijuana Treatment

Provide any information or studies regarding any beneficial or adverse effects from the use of marijuana in patients with the condition, treatment or disease that is the subject of the petition.

- Supporting evidence needs to be from professionally recognized sources such as peer reviewed articles or professional journals.
- Attach complete copies of any article or reference, not abstracts.

SEE Sections P and Q

Section I: Professional Recommendations for Medical Marijuana Treatment

Attach letters in support of your petition from physicians or other licensed health care professionals knowledgeable about the condition, treatment or disease at issue.

See Section R

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Section J: Submission of Petition
In the event you are unable to answer or provide the required documentation to any of the Sections above (excluding Section D); provide a detailed explanation indicating what you believe is "good cause" for not doing so. • Attach additional pages as necessary.

I hereby certify that the above information is correct and complete.	
My signature below attests that the information provided in this petition is true and that the attached documents are authentic. I formally request that the commissioner present my petition and all supporting evidence to the Board of Physicians for consideration.	
Signatu [redacted]	Date Signed: 9/29/16

Duchenne muscular dystrophy

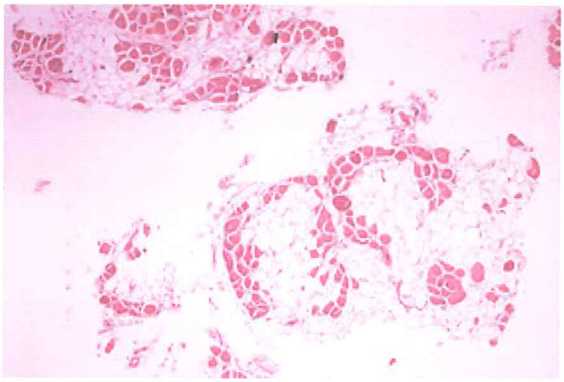
From Wikipedia, the free encyclopedia

Duchenne muscular dystrophy (DMD) is an X-linked recessive form of muscular dystrophy, affecting around 1 in 3,600 boys, which results in muscle degeneration and premature death.[1] The disorder is caused by a mutation in the gene dystrophin, located on the human X chromosome, which codes for the protein dystrophin. Dystrophin is an important component within muscle tissue that provides structural stability to the dystroglycan complex (DGC) of the cell membrane. While both sexes can carry the mutation, females are rarely affected.[2]

Symptoms usually appear in boys between the ages of 2 and 3 and may be visible in early infancy.[3] Even though symptoms do not appear until early infancy, laboratory testing can identify children who carry the active mutation at birth.[4] Progressive proximal muscle weakness of the legs and pelvis associated with loss of muscle mass is observed first. Eventually this weakness spreads to the arms, neck, and other areas. Early signs may include pseudohypertrophy (enlargement of calf and deltoid muscles), low endurance, and difficulties in standing without help or an inability to walk up stairs. As the condition progresses, muscle tissue experiences wasting and is eventually replaced by fat and fibrotic tissue (fibrosis). By age 10, braces may be required to aid in walking but most patients are wheelchair dependent by age 12. Later symptoms may include abnormal bone development that lead to skeletal deformities, including curvature of the spine. Due to progressive deterioration of muscle, loss of movement occurs, eventually leading to paralysis. Intellectual impairment may or may not be present but if present, does not progressively worsen as the child ages. The average life expectancy for individuals afflicted with DMD is around 25.[1]

Contents

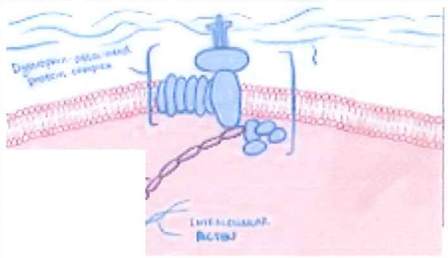
Duchenne muscular dystrophy



Histopathology of gastrocnemius muscle from patient who died of pseudohypertrophic muscular dystrophy, Duchenne type. Cross section of muscle shows extensive replacement of muscle fibers by adipose cells.

Classification and external resources

Specialty	Medical genetics, pediatrics
ICD-10	G71.0 (http://apps.who.int/classifications/icd10/browse/2016/en#/G71.0)
ICD-9-CM	359.1 (http://www.icd9data.com/getICD9Code.ashx?icd9=359.1)
OMIM	310200 (http://omim.org/entry/310200)
DiseasesDB	3985 (http://www.diseasesdatabase.com/ddb3985.htm)
MedlinePlus	000705 (http://www.nlm.nih.gov/medlineplus/ency/article/000705.htm)
Patient UK	Duchenne muscular dystrophy (http://patient.info/doctor/duchenne-muscular-dystrophy)
MeSH	D020388 (https://www.nlm.nih.gov/cgi/mesh/2016/MB_cgi?field=uid&term=D020388)



Video explanation of Duchenne and Becker muscular dystrophy

Signs and symptoms

The main symptom of Duchenne muscular dystrophy, a progressive neuromuscular disorder, is muscle weakness associated with muscle wasting with the voluntary muscles being first affected, especially those of the hips, pelvic area, thighs, shoulders, and calves. Muscle weakness also occurs later, in the arms, neck, and other areas. Calves are often enlarged. Symptoms usually appear before age 6 and may appear in early infancy. Other physical symptoms are:

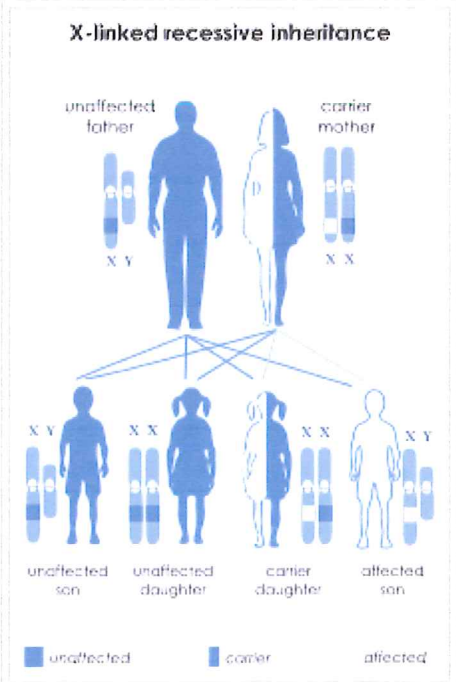
- Awkward manner of walking, stepping, or running – (patients tend to walk on their forefeet, because of an increased calf muscle tone. Also, toe walking is a compensatory adaptation to knee extensor weakness.)
- Frequent falls
- Fatigue
- Difficulty with motor skills (running, hopping, jumping)
- Lumbar hyperlordosis, possibly leading to shortening of the hip-flexor muscles. This has an effect on overall posture and a manner of walking, stepping, or running.
- Muscle contractures of Achilles tendon and hamstrings impair functionality because the muscle fibers shorten and fibrose in connective tissue
- Progressive difficulty walking
- Muscle fiber deformities
- Pseudohypertrophy (enlarging) of tongue and calf muscles. The muscle tissue is eventually replaced by fat and connective tissue, hence the term pseudohypertrophy.
- Higher risk of neurobehavioral disorders (e.g., ADHD), learning disorders (dyslexia), and non-progressive weaknesses in specific cognitive skills (in particular short-term verbal memory), which are believed to be the result of absent or dysfunctional dystrophin in the brain.
- Eventual loss of ability to walk (usually by the age of 12)
- Skeletal deformities (including scoliosis in some cases)
- Trouble getting up from lying or sitting position[3]

According to Lewis P. Rowland, in the anthology *Gene Expression In Muscle,* if a boy is affected with Duchenne muscular dystrophy (DMD), the condition can be observed clinically from the moment he takes his first steps. It becomes harder and harder for the boy to walk; his ability to walk usually completely disintegrates between the time the boy is 9 to 12 years of age. Most men affected with DMD become essentially "paralyzed from the neck down" by the age of 21.[5] Muscle wasting begins in the legs and pelvis, then progresses to the muscles of the shoulders and neck, followed by loss of arm muscles and respiratory muscles. Calf muscle enlargement (pseudohypertrophy) is quite obvious. Cardiomyopathy particularly (dilated cardiomyopathy) is common, but the development of congestive heart failure or arrhythmia (irregular heartbeat) is only occasional.

- A positive Gowers' sign reflects the more severe impairment of the lower extremities muscles. The child helps himself to get up with upper extremities: first by rising to stand on his arms and knees, and then "walking" his hands up his legs to stand upright.
- Affected children usually tire more easily and have less overall strength than their peers.
- Creatine kinase (CPK-MM) levels in the bloodstream are extremely high.
- An electromyography (EMG) shows that weakness is caused by destruction of muscle tissue rather than by damage to nerves.
- Genetic testing can reveal genetic errors in the Xp21 gene.
- A muscle biopsy (immunohistochemistry or immunoblotting) or genetic test (blood test) confirms the absence of dystrophin, although improvements in genetic testing often make this unnecessary.
- Abnormal heart muscle (cardiomyopathy)
- Congestive heart failure or irregular heart rhythm (arrhythmia)
- Deformities of the chest and back (scoliosis)
- Enlarged muscles of the calves, buttocks, and shoulders (around age 4 or 5). These muscles are eventually replaced by fat and connective tissue (pseudohypertrophy).
- Loss of muscle mass (atrophy)
- Muscle contractures in the heels, legs
- Muscle deformities
- Respiratory disorders, including pneumonia and swallowing with food or fluid passing into the lungs (in late stages of the disease)[1]

Cause

Duchenne muscular dystrophy (DMD) is caused by a mutation of the dystrophin gene at locus Xp21, located on the short arm of the X chromosome.[6] Dystrophin is responsible for connecting the cytoskeleton of each muscle fiber to the underlying basal lamina (extracellular matrix), through a protein complex containing many subunits. The absence of dystrophin permits excess calcium to penetrate the sarcolemma (the cell membrane).[7] Alterations in calcium and signalling pathways cause water to enter into the mitochondria, which then burst.



DMD is inherited in a X-linked recessive manner

In skeletal muscle dystrophy, mitochondrial dysfunction gives rise to an amplification of stress-induced cytosolic calcium signals and an amplification of stress-induced reactive-oxygen species (ROS) production. In a complex cascading process that involves several pathways and is not clearly understood, increased oxidative stress within the cell damages the sarcolemma and eventually results in the death of the cell. Muscle fibers undergo necrosis and are ultimately replaced with adipose and connective tissue.

DMD is inherited in an X-linked recessive pattern. Females will typically be carriers for the disease while males will be affected. Typically, a female carrier will be unaware they carry a mutation until they have an affected son. The son of a carrier mother has a 50% chance of inheriting the defective gene from his mother. The daughter of a carrier mother has a 50% chance of being a carrier and a 50% chance of having two normal copies of the gene. In all cases, an unaffected father will either pass a normal Y to his son or a normal X to his daughter. Female carriers of an X-linked recessive condition, such as DMD, can show symptoms depending on their pattern of X-inactivation.Duchenne muscular dystrophy has an incidence of 1 in 3,600 male infants.[1] Mutations within the dystrophin gene can either be inherited or occur spontaneously during germline transmission.

Diagnosis

Genetic counseling is advised for people with a family history of the disorder. Duchenne muscular dystrophy can be detected with about 95% accuracy by genetic studies performed during pregnancy.[1]

DNA test

The muscle-specific isoform of the dystrophin gene is composed of 79 exons, and DNA testing and analysis can usually identify the specific type of mutation of the exon or exons that are affected. DNA testing confirms the diagnosis in most cases.[8]

Muscle biopsy

If DNA testing fails to find the mutation, a muscle biopsy test may be performed.[9] A small sample of muscle tissue is extracted using a biopsy needle. The key tests performed on the biopsy sample for DMD are immunocytochemistry and immunoblotting for dystrophin, and should be interpreted by an experienced neuromuscular pathologist.[10] These tests provide information on the presence or absence of the protein. Where the protein is absent, this is a positive test for DMD. Where dystrophin is present, the tests will indicate the amount and molecular size of dystrophin, helping to distinguish DMD from milder dystrophinopathy phenotypes.[11] Over the past several years DNA tests have been developed that detect more of the many mutations that cause the condition, and muscle biopsy is not required as often to confirm the presence of Duchenne's.[12]

Prenatal tests

DMD is carried by an X-linked recessive gene. Males have only one X chromosome, so one copy of the mutated gene will cause DMD. Fathers cannot pass X-linked traits on to their sons, so the mutation is transmitted by the mother.[13]

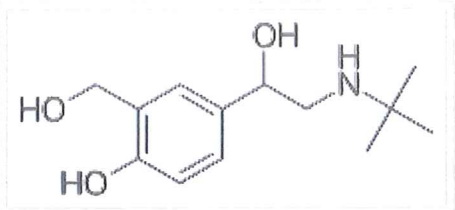
If the mother is a carrier, and therefore one of her two X chromosomes has a DMD mutation, there is a 50% chance that a female child will inherit that mutation as one of her two X chromosomes, and be a carrier. There is a 50% chance that a male child will inherit that mutation as his one X chromosome, and therefore have DMD.Prenatal tests can tell whether their unborn child has the most common mutations. There are many mutations responsible for DMD, and some have not been identified, so genetic testing only works when family members with DMD have a mutation that has been identified.

Prior to invasive testing, determination of the fetal sex is important; while males are sometimes affected by this X-linked disease, female DMD is extremely rare. This can be achieved by ultrasound scan at 16 weeks or more recently by free fetal DNA testing. Chorion villus sampling (CVS) can be done at 11–14 weeks, and has a 1% risk of miscarriage. Amniocentesis can be done after 15 weeks, and has a 0.5% risk of miscarriage. Fetal blood sampling can be done at about 18 weeks. Another option in the case of unclear genetic test results is fetal muscle biopsy.

Treatment

There is no cure for DMD, and an ongoing medical need has been recognized by regulatory authorities.[14] Phase 1-2a trials with exon skipping treatment for certain mutations have halted decline and produced small clinical improvements in walking.

Treatment is generally aimed at controlling the onset of symptoms to maximize the quality of life which can be measured using specific questionnaires,[15] and include the following:



Beta2-agonist

- Corticosteroids such as prednisolone and deflazacort lead to short term improvements in muscle strength and function up to 2 years.[16] Corticosteroids have also been reported to help prolong walking, though the evidence for this is not robust.[17]
- Randomised control trials have shown that beta2-agonists increase muscle strength but do not modify disease progression. Follow-up time for most RCTs on beta2-agonists is only around 12 months and hence results cannot be extrapolated beyond that time frame.
- Mild, non-jarring physical activity such as swimming is encouraged. Inactivity (such as bed rest) can worsen the muscle disease.
- Physical therapy is helpful to maintain muscle strength, flexibility, and function.
- Orthopedic appliances (such as braces and wheelchairs) may improve mobility and the ability for self-care. Form-fitting removable leg braces that hold the ankle in place during sleep can defer the onset of contractures.
- Appropriate respiratory support as the disease progresses is important.

Comprehensive multi-disciplinary care standards/guidelines for DMD have been developed by the Centers for Disease Control and Prevention (CDC), and were published in two parts in The Lancet Neurology in 2010. To download the two articles in PDF format, go to the TREAT-NMD website.[18]

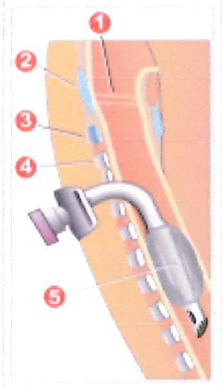
Physical therapy

Physical therapists are concerned with enabling patients to reach their maximum physical potential. Their aim is to:

- minimize the development of contractures and deformity by developing a programme of stretches and exercises where appropriate
- anticipate and minimize other secondary complications of a physical nature by recommending bracing and durable medical equipment
- monitor respiratory function and advise on techniques to assist with breathing exercises and methods of clearing secretions

Respiration assistance

Modern "volume ventilators/respirators," which deliver an adjustable volume (amount) of air to the person with each breath, are valuable in the treatment of people with muscular dystrophy related respiratory problems. The ventilator may require an invasive endotracheal or tracheotomy tube through which air is directly delivered, but, for some people non-invasive delivery through a face mask or mouthpiece is sufficient. Positive airway pressure machines, particularly bi-level ones, are sometimes used in this latter way. The respiratory equipment may easily fit on a ventilator tray on the bottom or back of a power wheelchair with an external battery for portability.



Tracheotomy

Ventilator treatment may start in the mid to late teens when the respiratory muscles can begin to collapse. If the vital capacity has dropped below 40 percent of normal, a volume ventilator/respirator may be used during sleeping hours, a time when the person is most likely to be under ventilating ("hypoventilating"). Hypoventilation during sleep is determined by a thorough history of sleep disorder with an oximetry study and a capillary blood gas (See Pulmonary Function Testing).

A cough assist device can help with excess mucus in lungs by hyperinflation of the lungs with positive air pressure, then negative pressure to get the mucus up.If the vital capacity continues to decline to less than 30 percent of normal, a volume ventilator/respirator may also be needed during the day for more assistance. The person gradually will increase the amount of time using the ventilator/respirator during the day as needed.However, there are also people with the disease in their 20's who have no need for a ventilator.

Prognosis

Duchenne muscular dystrophy is a rare progressive disease which eventually affects all voluntary muscles and involves the heart and breathing muscles in later stages. As of 2013, the life expectancy is estimated to be around 25,[1] but this varies from patient to patient. Recent advancements in medicine are extending the lives of those afflicted. The *Muscular Dystrophy Campaign*, which is a leading UK charity focusing on all muscle disease, states that "with high standards of medical care young men with Duchenne muscular dystrophy are often living well into their 30s".[19]

In rare cases, persons with DMD have been seen to survive into the forties or early fifties, with the use of proper positioning in wheelchairs and beds, ventilator support (via tracheostomy or mouthpiece), airway clearance, and heart medications, if required. Early planning of the required supports for later-life care has shown greater longevity in people living with DMD.

Curiously, in the mdx mouse model of Duchenne muscular dystrophy, the lack of dystrophin is associated with increased calcium levels and skeletal muscle myonecrosis. The intrinsic laryngeal muscles (ILM) are protected and do not undergo myonecrosis.[20] ILM have a calcium regulation system profile suggestive of a better ability to handle calcium changes in comparison to outher muscles, and this may provide a mechanistic insight for their unique pathophysiological properties.[21] The ILM may facilitate the development of novel strategies for the prevention and treatment of muscle wasting in a variety of clinical scenarios.[22]

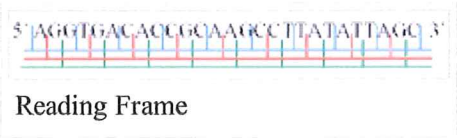
Ongoing research

Current research includes exon-skipping, stem cell replacement therapy, analog up-regulation, gene replacement and supportive care to slow disease progression.

Exon-skipping

Antisense oligonucleotides (oligos), structural analogs of DNA, are the basis of a potential therapy for patients afflicted with DMD. The compounds allow faulty parts of the dystrophin gene to be skipped when it is transcribed to RNA for protein production, permitting a still-truncated but more functional version of the protein to be produced.[23]

Two kinds of antisense oligos, 2'-O-methyl phosphorothioate oligos (like drisapersen) and Morpholino oligos (like eteplirsen), have been tested in early-phase clinical trials for DMD and have restored some dystrophin expression in muscles of DMD patients with a particular class of DMD-causing mutations. Clinical trials are ongoing.[24][25]



Reading Frame

Oligo-mediated exon skipping has resulted in clinical improvement in 12 patients in a Phase 1-2a study. On a standard test, the 6-minute walk test, patients whose performance had been declining instead improved, from 385 meters to 420 meters.[26][27] DMD may result from mRNA that contains out-of-frame mutations (e.g. deletions, insertions or splice site mutations), resulting in frameshift or early termination so that in most muscle fibers no functional dystrophin is produced

(though some revertant muscle fibers produce some dystrophin). In many cases an antisense oligonucleotide can be used to trigger skipping of an adjacent exon to restore the reading frame and production of partially functional dystrophin.

'atients with Becker's muscular dystrophy, which is milder than DMD, have a form of dystrophin which is functional even though it is shorter than normal dystrophin.[28] In 1990 England *et al.* noticed that a patient with mild Becker muscular dystrophy was lacking 46% of his coding region for dystrophin.[28] This functional, yet truncated, form of dystrophin gave rise to the notion that shorter dystrophin can still be therapeutically beneficial. Concurrently, Kole *et al.* had modified splicing by targeting pre-mRNA with antisense oligonucleotides (AONs).[29] Kole demonstrated success using splice-targeted AONs to correct missplicing in cells removed from beta-thalassemia patients[30][31] Wilton's group tested exon skipping for muscular dystrophy.[32][33] Successful preclinical research led to the current efforts to use splice-modifying oligos to change DMD dystrophin to a more functional form of dystrophin, in effect converting Duchenne MD into Becker MD.

Though AONs hold promise, one of their major pitfalls is the need for periodic redelivery into muscles. Systemic delivery on a recurring basis is being tested in humans.[34] To circumvent the requirement for periodic oligo delivery, a long-term exon-skip therapy is being explored. This therapy consists of modifying the U7 small nuclear RNA at the 5' end of the non-translated RNA to target regions within pre-mRNA. This has been shown to work in the DMD equivalent mouse, mdx.[35]

Stem cell replacement

Though stem cells isolated from the muscle (satellite cells) have the ability to differentiate into myotubes when injected directly into the muscle of animals, they lack the ability to spread systemically throughout. To effectively .eliver a therapeutic dose to an isolated muscle it would require direct injections to that muscle every 2mm.[36] This problem was circumvented by using another multipotent stem cell, termed pericytes, that are located within the blood vessels of skeletal muscle. These cells have the ability to be delivered systemically and uptaken by crossing the vascular barrier. Once past the vasculature, pericytes have the ability to fuse and form myotubes.[37] This means that they can be injected arterially, crossing through arterial walls into muscle, where they can differentiate into potentially functional muscle. These findings show potential for stem cell therapy of DMD. The pericyte-derived cells would be extracted, grown in culture, and then these cells would be injected into the blood stream where the possibility exists that they might find their way into injured regions of skeletal muscle.

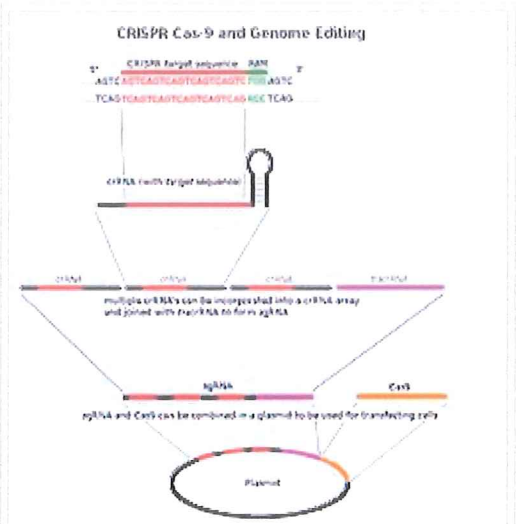
Gene therapy

In 2014 and 2015, researchers used a new gene editing method to correct a mutation that leads to Duchenne muscular dystrophy (DMD) in a mouse model of the condition. Researchers used a technique called CRISPR/Cas9-mediated genome editing, which can precisely remove a mutation in the dystrophin gene in DNA, allowing the body's DNA repair mechanisms to replace it with a normal copy of the gene. The benefit of this over other gene therapy techniques is that it can permanently correct the "defect" in a gene rather than just transiently adding a "functional" one.

Genome editing through the CRISPR/Cas9 system is not currently feasible in humans. However, it may be possible, through advancements in technology, to use this technique to develop therapies for DMD in the future.[38][39]In 2007, researchers did the world's first clinical (viral-mediated) gene therapy trial for Duchenne MD.[40]

Biostrophin is a delivery vector for gene therapy in the treatment of Duchenne muscular dystrophy and Becker muscular dystrophy.[41]

Clinical trials



CRISPR overview

While PTC124 showed promising results in mice,[42][43] the Phase II trial was suspended when participants did not show significant increases in the six-minute walk distance.[44]The Phase II trial of ACE-031 (a decoy receptor) was suspended due to safety issues.[45][46]

Safety and efficacy studies of antisense oligonucleotides for exon skipping in Duchenne muscular dystrophy with Morpholino oligos (e.g. eteplirsen)[47] and with 2'-O-methyl phosphorothioate oligos (e.g. drisapersen)[48] are in progress.

In 2011, in a study by the UK Medical Research Council and Sarepta Therapeutics (formerly known as AVI BioPharma), researchers trialled a new drug, known as Eteplirsen(*AVI-4658*), designed to make the body bypass genetic mutations when producing dystrophin. When given to 19 children with Duchenne muscular dystrophy, researchers found that higher doses of the drug led to an increase in dystrophin. Researchers believe that drugs which are designed to make the body "skip over" mutations in this way could be used to treat approximately 83% of Duchenne muscular dystrophy cases. However, the drug used in this trial only targeted mutations in a region implicated in 13% of cases. This study was conducted well and demonstrated the potential of this approach for increasing the levels of dystrophin in the short term. The trial's principal aim was to work out the appropriate dosages of the drug, therefore the drug's safety profile and effects will need to be confirmed in larger, longer-term studies, particularly as patients would need to take it for the rest of their lives (or until a better treatment is available).[49]

A small study published in May 2014 in the journal *Neurology* showed that the erectile dysfunction drug sildenafil could improve blood flow in boys affected with Duchenne MD. A larger and longer trial of the related drug tadalafil is underway to determine if improved blood flow will translate into improved muscle function.[50]

Preclinical trials

Rimeporide, a sodium–hydrogen antiporter 1 inhibitor, is in preclinical trials as of May 2015.[51]

History

The disease was first described by the Neapolitan physician Giovanni Semmola in 1834 and Gaetano Conte in 1836.[52][53][54] However, DMD is named after the French neurologist Guillaume-Benjamin-Amand Duchenne (1806–1875), who, in the 1861 edition of his book "*Paraplegie hypertrophique de l'enfance de cause cerebrale*", described and detailed the case of a boy who had this condition. A year later, he presented photos of his patient in his "*Album de photographies pathologiques*." In 1868 he gave an account of 13 other affected children. Duchenne was the first who did a biopsy to obtain tissue from a living patient for microscopic examination.[55][56]

Notable people with Duchenne muscular dystrophy

Alfredo Ferrari (born January, 1932 in Modena), nicknamed Alfredino or Dino, was the son of Enzo Ferrari. He designed the 1.5 L DOHC V6 engine for F2 at the end of 1955. Dino would never see the engine; he died 30 June 1956 in Modena at the age of 24, before his namesake automobiles Fiat Dino and Dino (automobile) were produced.

Rapper, Darius Weems, has the disease and has used is notoriety to raise awareness and funds for treatment.[57] His brother also suffered from the disease until his death at age 19. *Darius Goes West* is a documentary that depicts his journey of growth and acceptance of having the disease.A book entitled, *The Revised Fundamentals of Caregiving*, was released in 2012, written by Jonathan Evison. Netflix produced a film titled, *The Fundamentals of Caring*, in 2016 based on the novel. Both media depict a young man suffering from the disease.

References

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- Hulmi et al. 2016 Effects of muscular dystrophy, exercise and blocking activin receptor IIB ligands on the unfolded protein response and oxidative stress. (https://www.ncbi.nlm.nih.gov/pubmed/27554968) National Center for Biotechnology Information

External links

- CDC's National Center on Birth Defects and Developmental Disabilities (http://www.cdc.gov/ncbddd/duchenne/index.htm) (previously listed below as "Duchenne/Becker Muscular Dystrophy, NCBDDD") at CDC
- Genes and Disease Page at (http://www.ncbi.nlm.nih.gov/books/bv.fcgi?call=bv.View..ShowSection&rid=gnd.section.161) NCBI

- Muscular Dystrophies (https://www.dmoz.org/Health/Conditions_and_Diseases/Neurological_Disorders/Muscle_Diseases/Muscular_Dystrophies) at DMOZ

Retrieved from "https://en.wikipedia.org/w/index.php?title=Duchenne_muscular_dystrophy&oldid=736324982"

Categories: Muscular dystrophy | X-linked recessive disorders

How Cannabis Benefits Muscular Dystrophy

Scientific studies on cannabis and MD are sorely lacking despite the fact cannabis has been shown effective against common symptoms of MD such as pain and stiffness. There is evidence suggesting it may help related conditions, e.g., amyotrophic lateral sclerosis, which has some similar characteristics, such as impaired movement and muscle loss. A **2010 study in The American Journal of Hospice & Palliative Care** described how cannabis could potentially benefit ALS through the following mechanisms. At least some of these effects could theoretically benefit MD as well.

- Reducing glutamate transmission
- Antioxidant activity
- Anti-inflammatory activity
- Modulation of microglial cell activity
- Prevents apoptosis (cell death) in healthy cells
- Neuroprotective and neurotrophic (helps neurons grow) effects
- Enhances function of mitochondria

Formal studies have determined cannabinoids are effective against pain, one of the most destructive symptoms of MD. A **double-blind, placebo-controlled trial in 2013** found even low doses of vaporized THC was effective for reducing neuropathic pain. An **earlier randomized trial** concluded that smoking cannabis three times daily reduced pain measures and improved sleep.

> "Doctors and nurses have seen that for many patients, cannabis is more useful, less toxic, and less expensive than the conventional medicines prescribed for diverse syndromes and symptoms, including multiple sclerosis, Crohn's disease, migraine headaches, severe nausea and vomiting, convulsive disorders, the AIDS wasting syndrome, chronic pain, and many others." – Lester Grinspoon, MD, Emeritus Professor of Psychiatry at Harvard Medical School

The only study directly examining cannabinoids and MD is an **article in Forensic Science**. The abstract seemed to suggest that THC and CBD may benefit symptoms of the disease. Unfortunately, due to the article's age, the full text is not available, leaving the researchers' complete observations a mystery.

Despite these amazing properties, it is unlikely that cannabis extracts alone could eliminate every symptom of MD. All forms are genetically inherited or derive from spontaneous mutations in genes. For example, in DMD, a mutation prevents the body from producing dystrophin, a protein that helps maintain the stability of muscles. Inherited genetic defects are especially difficult to treat, but since cannabinoids have shown promise in **normalizing the expression of genes**, they very well may be able to treat the root causes of MD.

Reports of Success from Muscular Dystrophy Patients

The scientific evidence certainly suggests that cannabinoids could help MD, but what really matters is how patients are responding. Numerous reports across the Internet suggest that patients are benefiting immensely from various cannabinoid therapies.

An **article from a New Jersey newspaper** described the experience of young Michael Oliveri. He suffered from tremendous MD-associated pain that numerous medications failed to relieve, so he used medicinal cannabis as a last resort. Oliveri said the medicine "miraculously improved" his quality of life, so much so that he knew he must say goodbye to family and friends in New Jersey to relocate to California to gain safe access to cannabis.

Dan Pope is a Colorado resident with MD. In a ***US News*** article, he stated that cannabis helps control his muscle spasms. It also makes his pain more tolerable. Another man named **Patrick McClellan** also reported that eating or vaporizing cannabis significantly reduces his muscle spasms and pain.

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Uses of Medical Marijuana

Medical Marijuana and Muscular Dystrophy

What Is Muscular Dystrophy?

Muscular dystrophy encompasses an entire group of more than 30 inherited disorders, all of which cause the loss of skeletal muscle tissue and accompanying muscle weakness. Unfortunately, all of the disorders that make up the muscular dystrophy, or MD, group are known to degenerate, or get worse over time. As a result, keeping the patient comfortable and as pain-free as possible is often one of the most prominent treatment goals. Muscular Dystrophy Common Groups Treated with Marijuana Among the common members of the group of MD disorders are Becker muscular dystrophy, Duchenne muscular dystrophy, Emery-Dreifuss muscular dystrophy, Facioscapulohumerol muscular dystrophy, Limb-girdle muscular dystrophy, Myotonia congenita, and Myotonic muscular dystrophy. Muscular dystrophy encompasses an entire group of more than 30 inherited disorders, all of which cause the loss of skeletal muscle tissue and accompanying muscle weakness.

Medical Marijuana and Muscular Dystrophy

MD itself does not typically cause severe pain; however, secondary chronic pain associated with the disorders is estimated to affect two-thirds of the sufferers. Pain is caused by muscle cramps or spasms as well as stiff joints, pressure sores and muscle twitches. While traditional treatments such as physical therapy, heat application and exercise can alleviate some of the pain associated with MD, narcotic pain medication is often required at some point. Opiates, the group of pain medications typically prescribed for suffers of chronic pain, can help to alleviate pain; however, they also come at a high cost. Side effects of opiate based medications can be severe and dangerous. Aside from the risk of addiction, opiate based pain medications can also cause severe constipation, dizziness, drowsiness, respiratory depression, nausea, vomiting, difficulty urinating, itching and a variety of other negative side effects. In addition, patients who use opiate based narcotic pain medications typically build up a tolerance to the medication rather quickly, meaning more of the same medication is needed to control the pain.

Marijuana and Muscular Dystrophy

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Can Medical Marijuana Treat my Muscualr Dystrophy

All the MD disorders are inherited, meaning the genes causing the disorder are passed down through families. The age of onset, degree of muscle loss and weakness, rate at which the disorder progresses through the body, and the pattern of inheritance within the family can vary significantly among the MD disorders. Duchenne MD, the most common of all the MD disorders, for example, affects males at an early age, commonly between the ages of three and five years old. Duchenne MD also progresses rapidly, often leaving the sufferer unable to walk as early as age 12. Females in a Duchenne MD family have a 50 percent chance of passing the Duchenne MD gene down to their children. Myontic MD, on the other hand, typically waits until the adult years to show symptoms and progresses slower but can be marked by prolonged muscle spasms among other symptoms.

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Can Medical Marijuana Cure Muscular Dystrophy

Unfortunately, there is no known cure for any of the MD disorders. Conventional treatment attempts to control seizures and muscle spasms as well as provide physical, respiratory and speech therapy in order to give the patient the best quality of life possible. Medical marijuana and Muscular Dystrophy has been known to help treat some of the sideeffects associated with Muscualr Dystrophy. Unfortunately, all of the disorders that make up the muscular dystrophy, or MD, group are known to degenerate, or get worse over time. As a result, keeping the patient comfortable and as pain-free as possible is often one of the most prominent treatment goals. Among the common members of the group of MD disorders are Becker muscular dystrophy, Duchenne muscular dystrophy, Emery-Dreifuss muscular dystrophy, Facioscapulohumerol muscular dystrophy, Limb-girdle muscular dystrophy, Myotonia congenita, and Myotonic muscular dystrophy.

Medical Marijuana and Muscular Dystrophy: Clinical Evidence

Medical marijuana may help MD sufferers who live with chronic pain avoid building up a never-ending tolerance to opiate based pain medication. A recent study looked at the effect of adding medical marijuana to the daily regime of patients who consume opiate based pain medication for chronic pain. The study found that the participants experienced an average drop in pain level of 27 percent while not significantly affecting the blood-levels of the prescription drugs. For MD patients, in particular, excessive levels of opiates in the blood can be extremely dangerous given the respiratory problems common to MD sufferers. The fact that medical marijuana was able to reduce pain levels without increasing opiate blood levels is important.

Smoking marijuana has been found to be the most effective and rapid mechanism for relaying the active compounds to the brain, thereby allowing the sufferer to feel immediate relief from pain as well as offering better control over medication levels. Smoking anything, however, is clearly not good for your lungs or respiratory system. An MD sufferer may have a particularly compromised respiratory system. Luckily, there is another, equally effective, yet healthier mechanism for using medical marijuana - vaporization. Because the active compounds in marijuana, known as cannabinoids, are volatile, they can be vaporized at a temperature level significantly lower than that needed to reach combustion, or smoke. As a result, hot air can simply be drawn through the marijuana, which in turn vaporizes the cannabinoids and frees them for inhalation.

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MUSCULAR DYSTROPHY AND MEDICAL MARIJUANA

By Gooey Rabinski - Jul 16, 2015

Muscular dystrophy is a group of more than 30 distinct diseases that weakens muscles and interferes with movement. The condition is characterized by the loss of skeletal muscle tissue, resulting in extreme weakness, painful muscle spasms, and even deformities of the spine and hands. These conditions typically lead to a loss of the ability to sit up or walk and, in more severe cases, an inability to swallow or breath unassisted.

Like some types of multiple sclerosis and many other diseases, muscular dystrophy is progressive — meaning it continually advances and only worsens. It is the result of defects in muscle proteins and the death of muscle cells and tissue. The root cause of muscular dystrophy is inherited genetic defects.

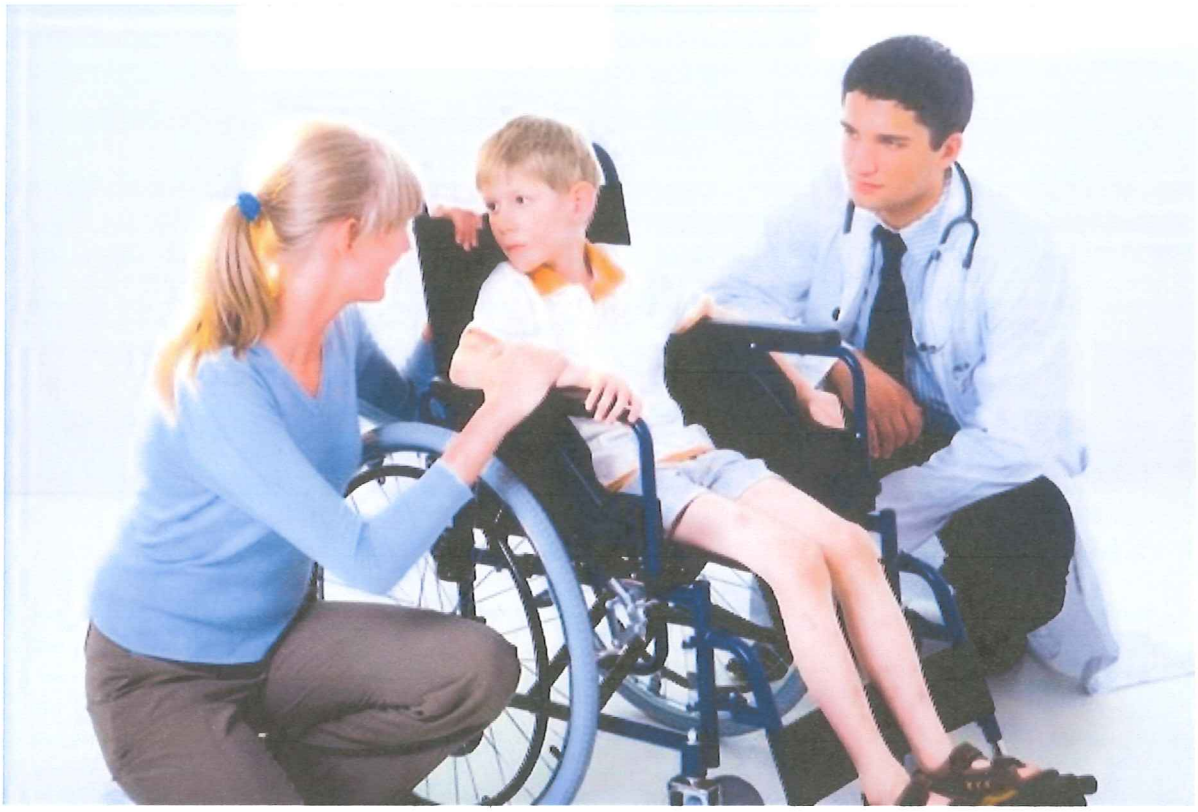
(https://www.whaxy.com/wp-content/uploads/2015/07/muscular-dystrophy-and-medical-marijuana-6.jpg)

Of those who are affected, one-third may suffer from cognitive impairment and problems with vision and speech. Muscular dystrophy disproportionately affects children, typically limiting the mobility of patients to the point that they cannot walk and sometimes can't feed or care for themselves. It can manifest itself from infancy to middle age. The severity of the disease is somewhat determined by the age at which patients become afflicted.

Accurate statistics for muscular dystrophy are few and far between; the condition is less common than many other diseases. About 15 out of 100,000 males who were five to 24 years old were affected in the United States in 2007. That's nearly 50,000 new cases of muscular dystrophy that year alone.

The most common type of muscular dystrophy is Duchenne, also known as DMD. It affects males between the ages of three and five and progresses rapidly. Another common variety is myontic muscular dystrophy, which typically strikes adults and progresses more slowly. While some perceive celebrity physicist and mathematician Stephen Hawking to have muscular dystrophy, he actually has a rare form of ALS.

Cannabis Useful for Symptoms



(https://www.whaxy.com/wp-content/uploads/2015/07/muscular-dystrophy-and-medical-marijuana.jpg)

It is theorized that relatively few muscular dystrophy patients are medicating with cannabis, possibly because so many are children and their parents are ignorant of the medical benefits of the plant — or hold religious beliefs that, ironically, prevent them from considering the herb. Those who do leverage marijuana to relieve their symptoms gain relief from pain, muscle spasms, drooling, loss of appetite, and insomnia. One of the most commonly reported benefits of consuming cannabis by muscular dystrophy patients is a good night's sleep.

It is estimated that two-thirds of muscular dystrophy patients suffer from secondary chronic pain resulting from muscle cramps, spasms, pressure sores, and muscle twitches. Often, opiates are prescribed to deal with the pain, resulting in a slew of negative side effects, including vomiting, dizziness, respiratory problems, nausea, and difficulty urinating — not to mention the risk of addiction (something cannabis, fortunately, doesn't feature).

Because muscular dystrophy is a disease with no known cure, the primary goal of treatment is to keep patients comfortable and free of pain. Unlike a condition such as cancer or **Crohn's (https://www.whaxy.com/learn/does-cannabis-cure-crohns)**, in which treatment with cannabis has been known to put the diseases into remission, treating muscular dystrophy patients with cannabis is simply a way of improving their quality of life.

Whether marijuana is decreasing chronic pain, wiping out insomnia, reducing **depression (http://bit.ly/1HymSgI)**, or simply alleviating the embarrassment of drooling into one's wheelchair, it has proven efficacy for those who are faced with no cure and a dire future as

their condition worsens. Given the terminal nature of the ailment, cannabis would show tremendous value if consumed only for the purpose of alleviating depression. However, it also shows tremendous benefit by the simple fact that it can prevent patients from becoming addicted to pharmaceutical pain killers.

(https://www.whaxy.com/wp-content/uploads/2015/07/muscular-dystrophy-and-medical-marijuana-5.jpg)

Because muscular dystrophy sufferers often experience respiratory problems, smoking isn't the best route of ingestion. While edibles are commonly available in many states that have legalized medical marijuana, they also aren't the best solution for those suffering from chronic pain because of slow onset (typically an hour or longer for full strength). **Vaporization (https://www.whaxy.com/learn/how-to-vaporize-cannabis)** is simply the best way muscular dystrophy patients can consume cannabis, delivering rapid onset and none of the problems associated with smoking.

The Studies

Unfortunately, due to the **Schedule I (https://www.whaxy.com/learn/does-cannabis-fight-hiv-aids)** status of marijuana in the United States, very little solid research has been conducted on how cannabis provides relief for sufferers of muscular dystrophy. However, muscular dystrophy is very similar to **Amyotrophic Lateral Sclerosis (http://bit.ly/1KVGBcS)**, or ALS (also known as Lou Gehrig's disease), for which cannabis has been proven to provide

great relief (one woman diagnosed with ALS was given two to five years to live — nearly 30 years ago). Thus, it is believed that cannabis can deliver much of the same relief to muscular dystrophy patients as it does for those suffering from ALS.

In 1977, **a study (http://www.ncbi.nlm.nih.gov/pubmed/903049)** was published in *Forensic Science* that indicated that **THC (https://www.whaxy.com/learn/what-is-thc)** and **CBD (https://www.whaxy.com/learn/cbd-medical-treatment)** are helpful for treating muscular dystrophy. Due to the age of the study, however, its full text is unavailable, obscuring its details.

Patient Testimonials

Adult muscular dystrophy patients have reported that cannabis helps a wide variety of their symptoms. The two most commonly cited advantages are a decrease in pain and a full night's sleep. In the terse words of **one patient (http://www.medicann.com/conditions-and-diseases/medical-cannabis-and-muscular-dystrophy/)**: "Less pain, more sleep."

Christa Mae (https://youtu.be/Sm9DBkNgQss), a muscular dystrophy patient in California, began using medical cannabis to treat her symptoms. Despite being extremely conservative and against all illegal drugs, Mae was willing to try cannabis due to the severity of her symptoms (she is wheelchair bound and has difficulty talking).

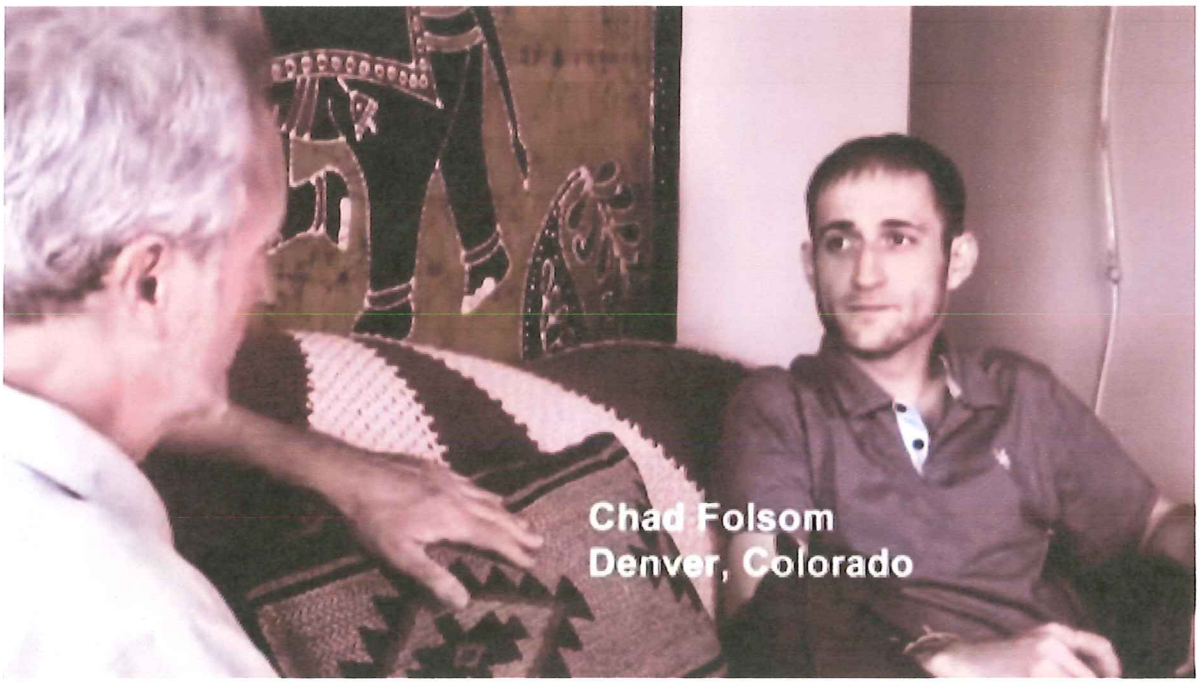
(https://www.whaxy.com/wp-content/uploads/2015/07/muscular-dystrophy-and-medical-marijuana-7b.jpg)

Mae described her use of cannabis as "life changing" during an interview at a medical marijuana dispensary.

> *"Pain will make you try many things. [When] I tried cannabis, it was like three inhalations, six minutes, [and] the pain was gone. The evidence was enough for me."*

Chad Folsom (https://youtu.be/g7TQso0qM4c) is a 31-year-old muscular dystrophy patient from Denver, Colorado. He has a severe form of muscular dystrophy that is extremely rare. Despite the debilitating nature of his condition, he said doctors treated him as a "drug seeker" because his prescribed drugs were ineffective or carried too many negative side effects, forcing Folsom to continue looking for a viable solution.

> *"The pills never worked. I always knew, even from the first time, that there was something in cannabis. That it did something different to me that nothing else did. As I got older, in my late teens, I started learning the medical aspects of it."*



(https://www.whaxy.com/wp-content/uploads/2015/07/muscular-dystrophy-and-medical-marijuana-8.jpg)

Unlike his pharmaceutical drugs, Folsom pointed out how he liked that cannabis conveyed almost no negative side effects and there was **no risk of overdose (https://www.whaxy.com/learn/can-you-overdose-marijuana)** or addiction. "I can take as much as I want of this and it won't hurt me."

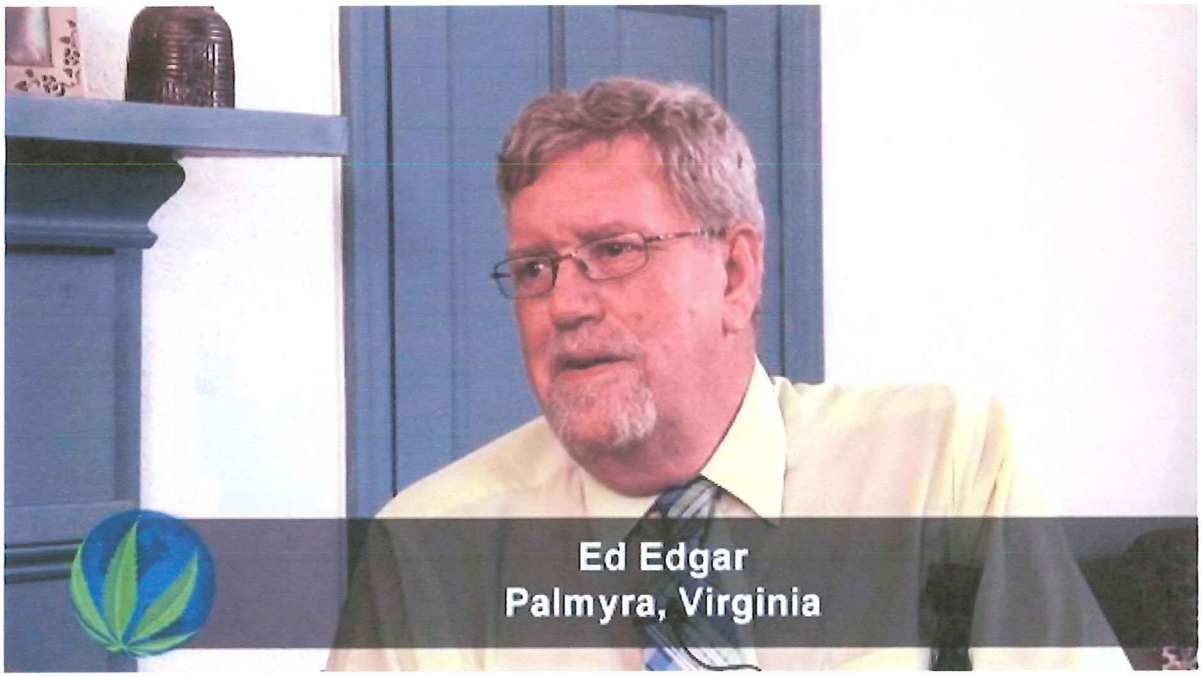
During an interview, Folsom described how he always informed doctors, who he said simply wanted to prescribe pharmaceutical drugs, that he had gained benefit from cannabis. "I would go to the doctors and...I would say that I use cannabis and that it's doing something for me. I'm able to eat. I'm able to sleep. I'm able to function every day. I'm able to be a productive member of society."

Unfortunately, Folsom reported how most doctors fought his use of marijuana. He even had doctors drug test him and say, "If you wanna be on these pills, we're gonna drug test you. Because I told them I used cannabis. I thought you were supposed to be honest with your doctor and tell them everything you're doing."

When asked how cannabis helps him, Folsom stated that it calms his nerves and helps his PTSD. "I'm able to be happier. I'm not depressed. I have a better outlook on life. I owe the plant everything. It changed my life." Folsom added how he has replaced *all* pharmaceutical drugs with medical marijuana.

> *"For years now, I have no need for pills. I am solely dependent on cannabis for all my medical needs."*

Ed Edgar (https://youtu.be/bljobl4ZlVk) is a middle aged man from Palmyra, Virginia who suffers from muscular dystrophy, which he has had all of his life. He experiences extreme weakness and chronic pain. "The best description of the kind of pain is, if you've ever had the flu really bad, and you have that deep, aching pain. It's like that."



(https://www.whaxy.com/wp-content/uploads/2015/07/muscular-dystrophy-and-medical-marijuana-9.jpg)

Edgar explained how doctors will prescribe him basically any type of barbiturate that he wants. "I have a prescription for Percocet and methadone. I take methadone every day and Percocet as needed." Unfortunately, he also described the negative side effects of the drugs that help keep him mobile and battle his pain.

> *"I can't stand them. They make me sick as a dog every time I take them. But I have to take something to knock the edge off."*

Edgar discovered that cannabis might be helpful when reading **Quest (http://quest.mda.org/)** magazine, a publication for sufferers of muscular dystrophy. "They were saying [cannabis] seemed to be one of the few things that actually worked on the pain." Unlike many patients, whose doctors are ignorant of the medical efficacy of marijuana, one of his doctors at a pain management center actually recommended cannabis. Two of his current physicians encourage his use of marijuana because of the extreme relief it delivers.

When asked if he benefits from use of cannabis for his muscular dystrophy, Edgar replied:

> *"It's one of the only things that works on me. The narcotics they give me basically knock me out. I can't function. If I would take the drugs they give me, at the level they give me, I couldn't work; I couldn't do anything."*

Edgar explained how, if he took his pharmaceutical drugs as prescribed, he'd be "a zombie." He described how, under conventional painkillers, he would be "stumbling all over the place." Without cannabis, Edgar was relegated to either living with pain or existing in a heavily drugged, narcotic state.

(https://www.whaxy.com/wp-content/uploads/2015/07/muscular-dystrophy-and-medical-marijuana-3.jpg)

Need for Research

Until more research is conducted, advocates of medical marijuana for muscular dystrophy will be unable to provide clinical evidence to prohibitionists for why cannabis is an effective treatment for the disease. Powerful testimonials are available, however, from patients of all ages.

For those who suffer from conditions like ALS, multiple sclerosis, and muscular dystrophy, cannabis is an effective way to deal with pain, depression, and insomnia — without the negative side effects of prescription drugs.

Photo credit: diseasespictures.com

Muscular Dystrophy – Medical Marijuana Research Overview

September, 2015

The following information is presented for educational purposes only. Medical Marijuana Inc. provides this information to provide an understanding of the potential applications of cannabidiol. Links to third party websites do not constitute an endorsement of these organizations by Medical Marijuana Inc. and none should be inferred.

Muscular dystrophies are a group of genetic diseases characterized by progressive muscle weakness and degeneration that primarily affect young boys. Studies have shown that marijuana helps reduce the pain and involuntary muscle contractions associated with the disease.

Overview of Muscular Dystrophy

Muscular dystrophy is a collection of genetic diseases that progressive degeneration of the skeletal muscles. The cause of muscular dystrophy is a defective gene, which is sometimes inherited, that causes damaged muscle fibers and muscle weakness.

There are many types of muscular dystrophy. The most common one is Duchenne muscular dystrophy, which accounts for about half of muscular dystrophy cases and typically affects boys, with symptoms of frequent falling, muscle pain and stiffness and waddling gait commonly appearing between the ages of 2 and 3. Myotonic is the most common type of muscular dystrophy that affects adults, and it is characterized by an inability to relax muscles after they contract. Other types of muscular dystrophy include Becker, Fascioscapulohumeral, Congenital, Emery-Dreifuss and Limb-girdle.

With muscular degeneration come additional complications like the inability to walk, contractions, breathing problems, scoliosis, and heart problems and swallowing problems.

While there is no cure for muscular dystrophy, treatment can help to manage the disease's associated symptoms and slow its progression. Corticosteroid medications and exercising helps to improve muscle strength and slow the disease's progression.

Findings: Effects of Cannabis on Muscular Dystrophy

Cannabis can help those with muscular dystrophy to manage the pain and involuntary muscle tightness commonly associated with the disease.

Two major cannabinoids found in cannabis, tetrahydrocannabinol (THC) and cannabidiol (CBD), effectively lower pain because they activate the two main cannabinoid receptors (CB1 and CB2) of the endocannabinoid system within the body. These receptors regulate the release of neurotransmitter and central nervous system immune cells to manage pain levels (Woodhams, Sagar, Burston & Chapman, 2015).

Top Resources

Medical Marijuana CBD Oil

Popular

CBD-Based Cannabis Products A
to All Florida Customers, Despite

Inflammation – Medical Marijuan
Research Overview

Cirrhosis – Medical Marijuana Re
Overview

Neuropathy – Medical Marijuana
Research Overview

New Study Finds Endocannabinc
Deficit Could Be Associated with
Subjective Pain Syndromes

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More Than 1,300 Companies Ap
Marijuana Business Licenses in C

Cannabis has even been found to significantly improve neuropathic pain in patients who had previously attempted to treat their discomfort with more conventional methods (Wilsey, et al., 2013). One study found that smoking cannabis three times daily for five days reduced the intensity of chronic pain and improved sleep (Ware, et al., 2010).

Along with pain, muscle spasm (involuntary muscle tightness) is the most common reason that medical cannabis is recommended and prescribed by medical professionals (Borgelt, Franson, Nussbaum & Wang, 2013). Evidence suggests that, like pain, cannabinoid-induced reductions in muscle tremors and spasticity are due to the activation of the CB1 and CB2 receptors (Pertwee, 2002). Studies have demonstrated that medical cannabis offers significant improvements in muscle spasticity, both in mice trials and in human subjects (Borgelt, Franson, Nussbaum & Wang, 2013) (Baker, et al., 2000).

States That Have Approved Medical Marijuana for Muscular Dystrophy

Currently, just Illinois, Louisiana, New Hampshire and New Jersey have approved medical marijuana specifically for the treatment of muscular dystrophy.

A number of other states, however, will consider allowing medical marijuana to be used for the treatment of muscular dystrophy with the endation of a physician. These states include: California (any debilitating illness where the medical use of marijuana has been ended by a physician), Connecticut (other medical conditions may be approved by the Department of Consumer Protection), usetts (other conditions as determined in writing by a qualifying patient's physician), Nevada (other conditions subject to approval), (other conditions subject to approval), Rhode Island (other conditions subject to approval), and Washington (any "terminal or ing condition").

ngton D.C., any condition can be approved for medical marijuana as long as a DC-licensed physician recommends the treatment.

on, 14 states have approved medical marijuana for the treatment of spasms (contractions/tightness), which can be a symptom ed with Myotonic and Emery-Dreifuss muscular dystrophies. These states include: Arizona, California, Colorado, Delaware, Florida, Maryland, Michigan, Minnesota, Montana, Nevada, Oregon, Rhode Island and Washington. Several states have approved medical ia specifically to treat "chronic pain." These states include: Alaska, Arizona, California, Colorado, Delaware, Hawaii, Maine, d, Michigan, Montana, New Mexico, Ohio, Oregon, Pennsylvania, Rhode Island and Vermont. The states of Nevada, New ire, Ohio and Vermont allow medical marijuana to treat "severe pain." The states of Minnesota, Ohio, Pennsylvania and Washington have approved cannabis for the treatment of "intractable pain."

Recent Studies on Cannabis' Effect on Muscular Dystrophy

Cannabis significantly improved neuropathic pain that had resisted previous conventional treatments.
Low-dose vaporized cannabis significantly improves neuropathic pain.
(http://www.ncbi.nlm.nih.gov/pubmed/23237736)

THC treatments reduced muscle tremors and spasms experienced in mice.
Cannabinoids control spasticity and tremor in a multiple sclerosis model.
(http://www.ncbi.nlm.nih.gov/pubmed/10716447)

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oodhams, S.G., Sagar, D.R., Burston, J.J., and Chapman, V. (2015). The role of the endocannabinoid system in pain. Handbook of Experimental Pharmacology, 227, 119-43.

(http://www.medicalmarijuana.com/)

Muscular Dystrophy-Cannabinoids-Symptom Relief

MUSCULAR DYSTROPHY (MD)

Muscular dystrophy is a group of inherited disorders that involve muscle weakness and loss of muscle tissue, which get worse over time.

Causes, incidence, and risk factors:

DMD is the most frequently occurring and one of the most rapidly progressive of the childhood neuromuscular disorders. It affects approximately (1 in 3000) live male births throughout the world. DMD type affects only boys (with extremely rare exceptions).
Muscular dystrophy (MD) refers to a group of genetic diseases characterized by progressive damage and weakness of facial, limb, breathing, and heart muscles. It is due to the lack of a key protein that is needed to maintain the integrity and proper function of the muscle. As the muscle tissue is damaged, the muscle bulk is reduced. Sometimes the muscle tissue can be replaced with fat and excessive scar tissue to make muscle appears larger than normal.

MD is categorized as listed below based on the clinical features, including inheritance pattern, muscles affected, and muscle biopsy features:

- Duchenne
- Becker
- Myotonic dystrophy
- Facioscapulohumeral
- Limb-girdle
- Oculopharyngeal
- Congenital
- Distal
- Emery-Dreifuss

More than thirty genes have been identified to cause different types of muscular dystrophies. Many muscular dystrophies are now diagnosed through gene tests.
MD can affect people of all ages. Although some forms first become apparent in infancy or childhood, others may not appear until middle age or later. Duchenne muscular dystrophy is the most common form affecting children, while myotonic MD is the most common form affecting adults.

There are three primary types of inheritance in which the faulty gene that causes MD can be passed along to offspring:

- X-linked recessive: Genes that are X-linked recessive are carried by the female on one of the X chromosomes that determine the sex of the child. As such, only boys will inherit conditions determined by these genes. Their mothers, known as carriers, will usually not show signs of the disease. A son of a carrier of MD has about a fifty percent chance of developing the disease, while a daughter of a carrier has a fifty percent chance of being a carrier. If a boy is unaffected, he cannot pass on MD; however, daughters from a man with an X-linked dystrophy will all be carriers. Duchenne/Becker and Emery-Dreifuss are X-linked recessive.

- Autosomal recessive: For this type of inheritance, both parents must carry and pass on the faulty gene. Neither parent shows any symptoms, but each of their offspring, regardless of gender, will have a twenty five percent chance of developing the disease. Limb-girdle type 2 MD and distal myopathy are autosomal recessive.

- Autosomal dominant: In the case of autosomal dominant inheritance, an affected person will have MD even though only one faulty gene has been passed along. This faulty gene can come from either parent, and it can affect either sex. Each child of an affected parent will have a fifty percent chance of developing MD. For this type of inheritance, the severity of MD can vary greatly. It can be so mild that it is not recognized, but it can also be severe. Myotonic dystrophy, facioscapulohumeral dystrophy (FSHD), and oculopharyngeal muscular dystrophy (OPMD) are autosomal dominant.

Muscular dystrophies, or MD, are a group of inherited conditions, which means they are passed down through families. They may occur in childhood or adulthood. There are many different types of muscular dystrophy. They include:

- Becker muscular dystrophy
- Duchenne muscular dystrophy (DMD)
- Emery-Dreifuss muscular dystrophy
- Facioscapulohumeral muscular dystrophy
- Limb-girdle muscular dystrophy
- Myotonia congenita
- Myotonic dystrophy

Symptoms:

Symptoms vary with the different types of muscular dystrophy.
All of the muscles may be affected. Or, only specific groups of muscles may be affected, such as those around the pelvis, shoulder, or face. Muscular dystrophy can affect adults, but the more severe forms tend to occur in early childhood.
Mental retardation (only present in some types of the condition)
Muscle weakness that slowly gets worse
Delayed development of muscle motor skills
Difficulty using one or more muscle groups
Drooling
Eyelid drooping (ptosis)

Frequent falls
Loss of strength in a muscle or group of muscles as an adult
Loss in muscle size
Problems walking (delayed walking)

Signs and tests:

A physical examination and your medical history will help the doctor determine the type of muscular dystrophy. Specific muscle groups are affected by different types of muscular dystrophy.

The doctor's exam may show:

Abnormally curved spine (scoliosis)
Joint contractures (clubfoot, clawhand, or others)
Low muscle tone (hypotonia)
Some types of muscular dystrophy involve the heart muscle, causing cardiomyopathy or disturbed heart rhythm (arrhythmias).
Often, there is a loss of muscle mass (wasting), which may be hard to see because some types of muscular dystrophy cause a build-up of fat and connective tissue that makes the muscle appear larger. This is called pseudohypertrophy.
A muscle biopsy may be used to confirm the diagnosis. In some cases, a DNA blood test may be all that is needed.

Other tests may include:

Heart testing – electrocardiography (ECG)
Nerve testing – electromyography (EMG)
Blood testing – including CPK level

Genetic testing for some forms of muscular dystrophy
This disease may also alter the results of the following tests:
Aldolase
AST
Creatinine
LDH
Myoglobin – urine and blood

Complications:

- Cardiomyopathy
- Decreased ability to care for self

- Decreased mobility
- Lung failure
- Tightening of muscles around the joints (contractures)
- Mental impairment (varies)
- Scoliosis

Treatment:

There are no known cures for the various muscular dystrophies. The goal of treatment is to control symptoms. Physical therapy may help patients maintain muscle strength and function. Orthopedic appliances such as braces and wheelchairs can improve mobility and self-care abilities. In some cases, surgery on the spine or legs may help improve function. Corticosteroids taken by mouth are sometimes prescribed to children to keep them walking for as long as possible. The person should be as active as possible. Complete inactivity (such as bedrest) can make the disease worse.?

There is no cure for muscular dystrophy, although some drugs still in the trial stage have shown promise in slowing or delaying the progression of the disease. The only FDA-approved drug for Duchenne is a steroid, which may prolong ambulation by two years. For the time being, treatment is aimed at preventing complications due to the effects of weakness, decreased mobility, contractures, scoliosis, heart defects, and respiratory weakness.

Physical therapy: Physical therapy, especially regular stretching, is important in helping to maintain the range of motion for affected muscles and to prevent or delay contractures. Strengthening other muscles to compensate for weakness in affected muscles may be of benefit also, especially in earlier stages of milder MD. Regular exercise is important in maintaining good overall health, but strenuous exercise may damage muscles further. For patients whose leg muscles are affected, braces may help lengthen the period of time that they can walk independently.

Surgery: If a patient's contractures have become more pronounced, surgery may be used to relieve the tension by cutting the tendon of the affected muscle, then bracing it in a normal resting position while it regrows.

Other surgeries are used to compensate for shoulder weakness in facioscapulohumeral MD, and to keep the breathing airway open for people with distal MD who sometimes experience sleep apnea. Surgery for scoliosis is often needed for patients with Duchenne MD.

Occupational therapy: Occupational therapy involves employing methods and tools to compensate for a patient's loss of strength and mobility. This may include modifications at home, dressing aids, wheelchair accessories, and communication aids.

Nutrition: Nutrition has not been shown to treat any conditions of MD, but it is essential to maintaining good health.

Cardiac care: Arrhythmias are often a symptom with Emery-Dreifuss and Becker MD and may need to be treated with special drugs. Pacemakers may also be needed in some cases, and heart transplants are becoming more common for men with Becker MD.

Respiratory care: When the muscles of the diaphragm and other respiratory muscles become too weak to function on their own, a patient may require a ventilator to continue breathing deeply enough. Air may also be administered through a tube or mouthpiece. It is therefore very important to maintain healthy lungs to reduce the risk of respiratory complications.

Expectations (prognosis):

The severity of disability depends on the type of muscular dystrophy. All types of muscular dystrophy slowly get worse, but how fast this happens varies widely. Some types of muscular dystrophy, such as Duchenne muscular dystrophy, are deadly. Other types cause little disability and people with them have a normal lifespan.

Prevention:

Genetic counseling is advised when there is a family history of muscular dystrophy. Women may have no symptoms but still carry the gene for the disorder. Duchenne muscular dystrophy can be detected with about 95% accuracy by genetic studies performed during pregnancy.
Why is genetic counselling important?
Each son of a female carrier has a 50% chance of inheriting DMD through his mother's faulty X chromosome and each daughter has a 50% chance of being a carrier of the disorder in the same way. Soon

after the diagnosis of DMD it is essential that genetic counselling is arranged, together with appropriate tests for those members of the family who are at risk of being carriers. Genetic counselling provides information on the inheritance pattern, risks to other family members, and the 'prognosis' (likely outcome of the disorder). This service also provides information about diagnostic testing, including prenatal testing, as well as carrier testing.

Cannabinoids Help Muscular Dystrophy Symptoms:

Cannabinoids are now known to have the capacity for neuromodulation, via direct, receptor-based mechanisms, at numerous levels within the nervous system. These provide therapeutic properties that may be applicable to the treatment of neurological disorders, including anti-oxidative, neuroprotective effects, analgesia, anti-inflammatory actions, immunomodulation, modulation of glial cells and tumor growth regulation. Beyond that, the cannabinoids have also been shown to be "remarkably safe with no potential for overdose."

(vaporizing) Marijuana:

"miraculously improved his quality of life so much so that he left his family and friends in New Jersey to live in California, where he can readily get his medication."

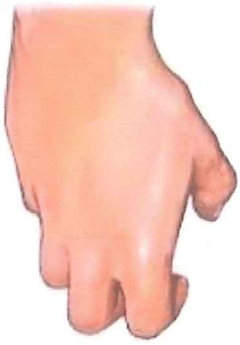
Sublingual (under the tongue)-tincture (alcohol based) or infused oil (olive or food grade glycerin or coconut)

Topicals (salves, ointments, balms) for muscle pain and spasms.

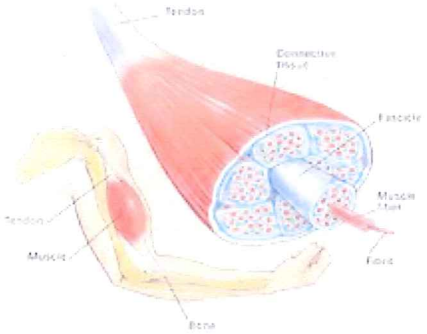
Cannabinoids: increase appetite, analgesic (rid pain), muscle relaxant, saliva reduction, bronchodialation, and sleep induction.

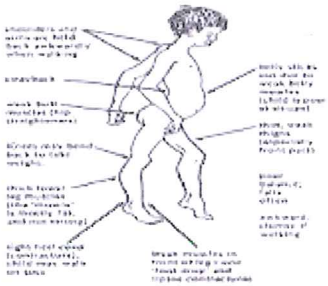
CBD-rich strains are best choice. Sativa dominant x Indica.

Strains: Martian Mean Green, Mako Haze, Lethal Purple, Jamaican Pearl, Heavy Duty Fruity, G13 x NYC Diesel, F13, A-Train, Casey Jones, Aurora Borealis, Hash Heaven, Jack Flash #5, KC-45, Kushage, Lemon Skunk, Blue Dragon, Cinderella x Panama Red, Kerala Krush, Fruit of the Gods, Mandala #1.



Contracture of fingers
of right hand (clawed hand)





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[WATCH] A Real Libertarian Answers the CNN Townhall Questions

Muscular Dystrophy Association

Name:

Position: **Pro** to the question "*Should Marijuana Be a Medical Option?*"

Reasoning:

"Smoking anything, including marijuana, is not healthful for the lungs and airway system. Despite risk for bronchitis, the main advantage of smoking is rapid onset of effect. When marijuana is smoked, the inhaled smoke is absorbed and delivered to the brain rapidly, allowing for one to control the effect. Fortunately there is a much healthier option called "vaporization." Because the cannabinoids (the active ingredients in marijuana) are volatile, they will vaporize at a temperature much lower than actual combustion. Heated air can be drawn through marijuana and the active compounds will vaporize, which can then be inhaled. This delivers the substance in a rapid manner that can be easily titrated to desired effect. This has been shown to remove the health hazards of smoking. Vaporizers can be purchased on the Internet.

Additionally, marijuana can be ingested orally, although oral ingestion of marijuana is quite different than inhalation. The onset of action is much slower and titration of dosing is more difficult. Maximum cannabinoid blood levels are only reached 1 to 3 hours after an oral dose.

There are really no other medications that have the same mechanisms of action as marijuana. Dronabinol (Marinol) is available by prescription in capsules, but has the distinct disadvantage of containing only synthetic delta-9-tetrahydrocannabinol (THC) which is only one of many therapeutically beneficial cannabinoids in the natural plant. Interestingly, it is the most psychoactive of the cannabinoids and is the one that the Federal government allows to be prescribed!

Cannabinoids are now known to have the capacity for neuromodulation, via direct, receptor-based mechanisms, at numerous levels within the nervous system. These provide therapeutic properties that may be applicable to the treatment of neurological disorders, including anti-oxidative, neuroprotective effects, analgesia, anti-inflammatory actions, immunomodulation, modulation of glial cells and tumor growth regulation. Beyond that, the cannabinoids have also been shown to be remarkably safe with no potential for overdose."
Gregory T. Carter, MD, Co-director, MDA/ALS Center at the University of Washington Medical Center, Oct. 2003

Theoretical Expertise Ranking: ☆ Organizations/VIPs/Others
Individuals and organizations that do not fit into the other star categories.

Description:

"The Muscular Dystrophy Association [MDA] is a voluntary health agency – a dedicated partnership between scientists and concerned citizens aimed at conquering neuromuscular diseases that affect more than a million Americans.

MDA combats neuromuscular diseases through programs of worldwide research, comprehensive medical and community services, and far-reaching professional and public health education."
"About MDA," MDA website (accessed Sep. 14, 2007)

Mission: "To stop neuromuscular diseases."
MDA website (accessed Sep. 14, 2007)

Structure: Nonprofit 501(c)(3)

Members/Constituents: Not membership based

Annual Budget: $199.8 million (2006 revenue)

Sr. Executive: Gerald C. Weinberg, President

# of Offices: Over 200 offices nationwide; headquarters in Tucson, AZ

# of Staff: 2 million+ volunteers

Relevant Affiliations:
- Jerry Lewis MDA Telethon

Contact Info:
Phone: 800-344-4863
Fax: None found
Email: mda@mdausa.org
Website: www.mda.org

HEADLINE NEWS > Do Mangoes Boost Your High?

DRILL DOWN

Cannabinoids

What are cannabinoids, the relationship between cannabinoids and the body. The chemically active compounds uniquely found in Cannabis ...

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The synergy of different compounds in marijuana is known as the entourage effect. To this day

MEDICAL

Can Cannabis Treat Muscular Dystrophy?

Feb 25, 2016

3

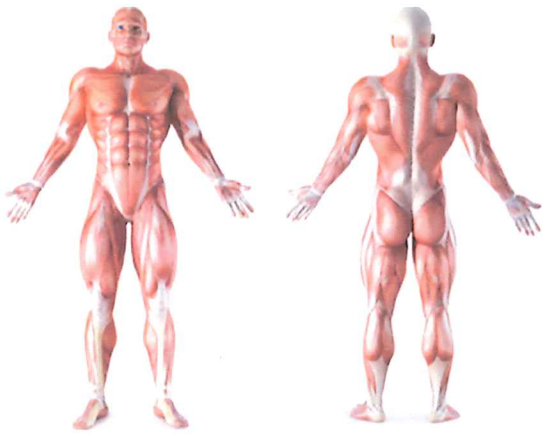
By definition, muscular dystrophies refer to the nine types that result in the degeneration of muscle mass. Each of these types of muscular dystrophy have their own unique manifestations. In other words, certain patients will not be able to sit or walk while others may just have issues breathing or swallowing.

By nature, muscular dystrophy is actually genetic, and the symptoms may begin to develop somewhere in childhood but will manifest in adulthood. One of the most common types of muscular dystrophy is Duchenne Muscular Dystrophy (DMD) which affects mostly boys in childhood.

There is no cure for this condition. Apart from exercise, respiratory care and physical exercise, cannabis might be able to help with both the complications and symptoms of this condition.

How Cannabis Affects Muscular Dystrophy

Studies that show the benefits of cannabis on muscular dystrophy are still lacking, even though cannabis has been proven to be effective when it comes to stiffness and pain. There is evidence that it helps related conditions such as amyotrophic lateral sclerosis that also include symptoms such as muscle loss and impaired movement.



In a study conducted in the American Journal of Hospice & Palliative Care, in 2010, it was described how cannabis could potentially benefit ALS through the following mechanisms:

1: Reducing glutamate transmission

2: Antioxidant and anti-inflammatory activity

3: Prevention of apoptosis in healthy cells

4: Modulation of microglial cell activity

5: Neuroprotective and neurotrophic effects

6: Improves function of mitochondria

In other words, and given these benefits, cannabis can theoretically benefit muscular dystrophy too.

There is one study that has revealed that cannabinoids have been most effective when it comes to dealing with pain – one of the most devastating effects of muscular dystrophy. Actually, a 2013 study that included a double-blind, placebo-controlled trial revealed that even the lowest doses of vaporized THC reduced neuropathic pain. A previous randomized trial showed that smoking cannabis three times a day not only reduces pain measures but also helped improve sleep.

As for MD, there is one study that exists as an article in Forensic Science that suggests that both THC and CBD could benefit the symptoms of the disease. Yet, due to the age of the article, the full text is not fully available to researchers.

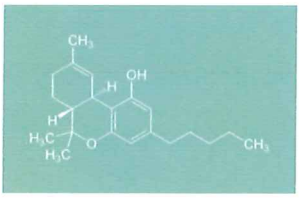
Rather admittedly, it must be pointed out that cannabis extracts, despite the amazing properties that they possess, are not able to eliminate every MD symptom.

As mentioned earlier, muscular dystrophy occurs due to mutations in genes. Since cannabis has shown that it is capable of

scientists have ...

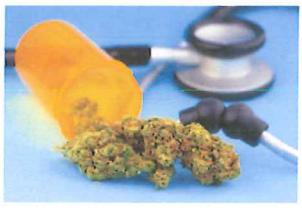
How Cannabis Can Help Cancer Patients

A study from Israel shows how cancer patients can benefit from marijuana. A lot of people recognize medicinal ...



Benefits of Using Tetrahydrocannabinol (THC)

What is THC? THC is the most famous cannabinoid found in cannabis. It is a psychoactive compound and, first ...



Australian children first to receive medical marijuana treatment

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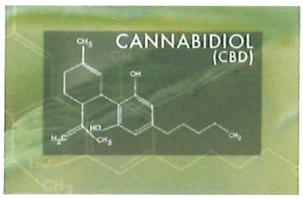


5 Facts You Need To Know About Cannabidiol (CBD)

CBD, or cannabidiol, is a chemical found in marijuana that is changing the discussion about whether marijuana should ...

normalizing the expression of these genes, it might also be able to treat the root causes of the genes too.

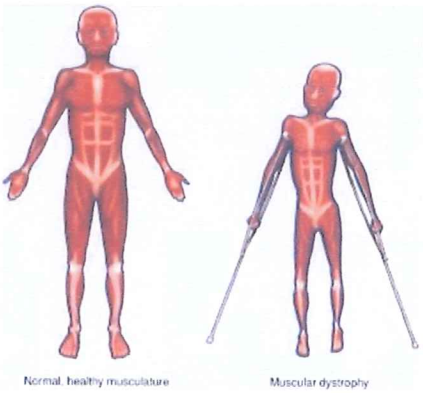
What Do Muscular Dystrophy Patients Have to Say?

There is scientific evidence to suggest that cannabinoids could help MD. Yet the best part is the reports about the number of patients that are responding to this treatment – especially over the Internet.

One article from a New Jersey newspaper spoke of a certain Michael Oliveri that suffered from MD-associated pain that a number of MD-related medication failed to help with. As a result, he used medicinal cannabis as a final resort. This medicine improved the quality of his life so much that he moved from New Jersey to California to gain access to cannabis much easier.

Another MD patient, Dan Pope, who lives in Colorado stated that it is cannabis that helps control his muscle spasms apart from making his pain far more tolerable. Another patient by the name Patrick McClellan spoke both of eating and vaporizing cannabis that helped with his muscle spasms and pain.

Medical Jane, a popular medical cannabis blog, spoke with John from Florida who has myotonic dystrophy who also explained that cannabis had the ability to cut down the pain while helping him relax and sleep. He also revealed that he prefers indica-dominant strains as opposed to sativa that can be too stimulating. It also reveals that since these type of strains affect the mind more than the body, it would work best for MD too.



The Future of Cannabis of Muscular Dystrophy Treatment

There is both scientific and anecdotal evidence that demonstrates that cannabis is effective for some symptoms in MD for a certain group of people. Still, research that uses high-quality extracts of MD is needed badly and could definitely reveal a number of other benefits.

3

Tags Cannabis marijuana muscular dystrophy symptoms

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Muscular Dystrophy (MD)

A group of diseases characterized by loss of muscle mass and weakness, and is caused by the inability t necessary to build healthy muscle. Sufferers of MD can lose the ability to walk and can become wheelch progressive loss of muscle mass is the main effect of MD, patients also report difficulty swallowing and t to perform basic life functions.

There are many different kinds of muscular dystrophy. Symptoms of the most common variety begin in boys. Other types don't surface until adulthood. Some people who have muscular dystrophy will eventu walk. Some may have trouble breathing or swallowing.

There are several types of MD and diagnosis is dependent upon the age of onset and muscle groups aff disease with over 30 known genes that cause different types of MD.

There is no cure for muscular dystrophy. But medications and therapy can help manage symptoms and disease.

The Past

There are no cures for any type of Muscular Dystrophy. The most commonly prescribed pharmaceutical variety of beta blockers should the disease affect the heart. Common therapies include range of motion maintain mobility in the patient for as long as possible. The use of braces is common and surgery is som correct damage to the spinal cord.

MD itself does not typically cause severe pain; however, secondary chronic pain associated with the disc affect two-thirds of the sufferers. Pain is caused by muscle cramps or spasms as well as stiff joints, pres twitches. While traditional treatments such as physical therapy, heat application and exercise can allevia associated with MD, narcotic pain medication is often required at some point. Opiates, the group of pai prescribed for suffers of chronic pain, can help to alleviate pain; however, they also come at a high cost. based medications can be severe and dangerous. Aside from the risk of addiction, opiate based pain me severe constipation, dizziness, drowsiness, respiratory depression, nausea, vomiting, difficulty urinating, other negative side effects. In addition, patients who use opiate based narcotic pain medications typicall the medication rather quickly, meaning more of the same medication is needed to control the pain.

The Plant

Cannabinoid therapy has been reported as effective by sufferers of Muscular Dystrophy for the treatme associated with the disease, including both THC and CBD. The neuroprotective, anti-inflammatory and a cannabis are also believed to help in the treatment of MD. Indica strains are more commonly reported a

Difference between CBD and THC in Medical Marijuana

THC, or tetrahydrocannabinol, is the chemical responsible for most of marijuana's psychological eff cannabinoid chemicals made naturally by the body, according to the National Institute on Drug Abu

Cannabinoid receptors are concentrated in certain areas of the brain associated with thinking, mer coordination and time perception. THC attaches to these receptors and activates them and affects pleasure, movements, thinking, concentration, coordination, and sensory and time perception, acc

THC is one of many compounds found in the resin secreted by glands of the marijuana plant. More found around the reproductive organs of the plant than on any other area of the plant. Other com marijuana, called cannabinoids, are present in this resin. One cannabinoid, CBD is nonpsychoactive National Center for Biotechnology Information, and actually blocks the high associated with THC.

Cannabidiol or CBD, is the cannabis compound that has significant medical benefits, but does not r and can actually counteract the psychoactivity of THC. CBD does not cause a high, unlike THC. The r psychoactive is due to its lack of affinity for CB1 receptors. CB1 receptors are found in high concent are the pathways responsible for the psychoactive effects of THC.

CBD and THC levels tend to vary between different strains and varieties of cannabis. By using selec we have managed to create varieties with high levels of CBD and THC.

Medical marijuana may help MD sufferers who live with chronic pain avoid building up a never-ending t pain medication. A recent study looked at the effect of adding medical marijuana to the daily regime of p opiate based pain medication for chronic pain. The study found that the participants experienced an ave 27 percent while not significantly affecting the blood-levels of the prescription drugs. For MD patients, ir levels of opiates in the blood can be extremely dangerous given the respiratory problems common to M medical marijuana was able to reduce pain levels without increasing opiate blood levels is important.

The Process

Smoking marijuana has been found to be the most effective and rapid mechanism for relaying the activ brain, thereby allowing the sufferer to feel immediate relief from pain as well as offering better control Research has shown vaporizing low doses of THC as effective in combating neuropathic pain.

Smoking

The benefit from smoking as a route of administration is instant action and the ability of the patien needed for relief.

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Tr
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Vaporizing or Vaping

If you don't like the idea of smoke there is the option to vaporize. Vaporization does not use combu medicine. Unfortunately there is some confusion out there about vaporizers. There are now hundr choose from. There are three basic types: pen, hand-help, and tabletop. The differences are in pric Some vaporizers claim to be able to vaporize plant matter (flowers), wax and oils. Some can only dc oil. The most important difference is the method used to heat the medicine. There are basically tw on the way)- conduction and convection.

True Vaporizing is done by convection, where air is heated, and in turn the hot air turns the medici then inhaled. Conduction Vaporizing happens when a hot element (metal plate, or bowl) touches th medicine is placed directly in a metal or ceramic bowl or chamber that is heated which then heats t smoke is inhaled. This is still combustion, and not truly vaporizing. This is closer to dabbing but with element.

Guidelines to Help Reduce the Side-Effects of NSAIDs (Non-Steroidal Anti-Inflammatory Agents)

How to Reduce Drug Side Effects

Theodore R. Fields, MD, FACP

Attending Physician, Hospital for Special Surgery

Professor of Clinical Medicine, Weill Cornell Medical College

Non-steroidal anti-inflammatory drugs (NSAIDs) are a group of drugs that are prescribed to reduce the pain and inflammation of arthritis. Some of these drugs require a prescription, while others are available without one (over-the-counter or OTC). They include such drugs such as (generic names first, brand names in parentheses):

aspirin
diclofenac (Voltaren)
etodolac (Lodine)
fenoprofen (Nalfon)
flurbiprofen (Ansaid)
ibuprofen (Motrin, Advil, Rufen)
meclofenamate (Meclomen)
naproxen (Aleve, Naprosyn)
indomethacin (Indocin)
ketoprofen (Orudis, Oruvail)
oxaprozin (Daypro)

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Rheumatology

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Can tight control of early RA - with a target - help you feel a lot better and reduce joint damage?

piroxicam (Feldene)
salsalate (Disalcid, Trilisate)
sulindac (Clinoril)
tolmetin (Tolectin)

NSAIDs do **not** include drugs that are purely pain relievers, such as acetaminophen (Tylenol) or codeine.

[A more recent group of NSAIDs known as COX-2 selective or COX-2 specific inhibitors are covered in a **separate article on COX-2 inhibitors** - presently limited to the agent celecoxib (Celebrex.)]

NSAIDs are generally tolerated very well by many patients, which is fortunate because these drugs are often very helpful for people with pain and inflammation. Most side effects are minor and easily reversible by discontinuing the drug or by adding a drug to counter such effects. The risk of serious side effects is small. Being aware of the possible side-effects of these drugs can make them even safer to use. Although most side-effects are minor, there is still a genuine concern re: gastrointestinal problems, such as ulcer development, and cardiovascular side-effects, as discussed.

If any of these guidelines are not clear, or if you think it does not apply to you, discuss the issue with your physician.

Gastrointestinal Symptoms

Gastrointestinal symptoms are the most common side effects of NSAIDs. They are most likely to be stomach irritation and the sensations known as "heart burn" (which has nothing to do with your heart). In severe cases, NSAIDs can irritate the lining of your stomach so that an ulcer (a small erosion) forms. In the worst cases, such an erosion can lead to internal bleeding, which may be life-threatening.

Stop the drug and call your physician immediately if you have any severe abdominal pain or a black, tarry stool (bowel movement) or any blood in your stool.

To help reduce irritation of the stomach and prevent an ulcer,

- *take NSAIDs at the end of a full meal, or with antacid;*
- limit alcohol intake (since alcohol can also irritate your stomach).

If you develop gastrointestinal problems, your physician may switch you to another drug (such as a COX-2 selective inhibitor - see section on this type of agent) or may add a drug to help reduce stomach irritation.

Drugs that reduce stomach irritation include misoprostol (Cytotec), or a proton pump inhibitor such as omeprazole (PriLosec), esomeprazole (Nexium), pantoprazole (Protonix), lansoprazole (Prevacid), or rabeprazole (Aciphex). Only lansoprazole, at this time, has received an official FDA indication for protection of ulcer in patients on non-steroidal anti-inflammatory agents. These drugs can considerably reduce your risk of an ulcer and internal bleeding.

The "black box warning" for NSAIDs related to gastrointestinal risk reads as follows, in an example from the labeling for the NSAID naproxen (Naprosyn®):

"*Gastrointestinal Risk*: NSAIDs cause an increased risk of serious gastrointestinal adverse events including bleeding, ulceration, and perforation of the stomach or intestines, which can be fatal. These events can occur at any time during use and without warning symptoms. Elderly patients are at greater risk for serious gastrointestinal events."

Heart Problems

The FDA has required a block box warning about cardiovascular thrombotic events be placed in the package description of all NSAIDs other than aspirin, including COX-2 specific and selective agent, and patients at high risk for cardiovascular disease need to weigh the risks and benefits with their physician before taking any NSAID or (COX-2 specific or selective agent). The "black box warning" for NSAID's related to cardiovascular risk reads as follows, in an example from the labeling for the NSAID naproxen (Naprosyn®):

"*Cardiovascular Risk*: NSAIDs may cause an increased risk of serious cardiovascular thrombotic events, myocardial infarction, and stroke, which can be fatal. This risk may increase with duration of use. Patients with cardiovascular disease or risk factors for cardiovascular disease may be at greater risk."

Dosing

When you are trying an NSAID for the first time, take the full dose prescribed every day, unless instructed otherwise. ***It may take as long as 2 weeks*** to build up to a "blood level" of the drug, and the drug may not help very much until then. If you take the drug irregularly, you may never know whether it actually can help you. This could lead to your being switched to a second drug when the first one actually could have helped. Each new drug you take carries a risk of allergic reaction (such as skin rash). Therefore, it's important to find out if a drug can help you before switching to another.

Do not exceed the dose of the drug prescribed. The extra benefit is usually small and the increased risk is significant.

If you are taking the medicine regularly and miss a dose, take it as soon as possible. However, if it is almost time for your next dose, skip the one you missed and go back to your regular schedule. Do not take a double dose. -- If your arthritis improves, discuss with your physician the possibility of decreasing your dose of the NSAID.

Combining NSAIDs with Other Drugs

Do not mix one NSAID with another. For example, don't take aspirin or ibuprofen with any other non-steroidal anti-inflammatory agents. However, your physician may wish you to combine low-dose aspirin with an NSAID for heart or stroke prevention. This is an individual decision for each patient, and you should discuss this with your physician, since combining an NSAID with aspirin can increase the risk of ulcer.

Acetaminophen, especially in low dose, appears less likely to irritate the stomach than NSAIDs, so in many cases it is reasonable to take

acetaminophen along with NSAIDs.

Always read the ingredients listed on the label of over-the-counter products. If acetylsalicylic acid or salicylate is listed, it may be better not to take this with NSAIDs, unless advised by your physician. Keep in mind that Alka-Seltzer, Anacin, some types of Excedrin, and even Pepto-Bismol contain aspirin.

If you are taking medications for high blood pressure, have your pressure checked regularly while on the non-steroidal anti-inflammatory agent. This is especially important within the first several weeks of starting the drug. In some patients, NSAIDs can elevate the blood pressure.

When to Stop the Drug and Get *Immediate* Medical Attention

If signs of allergy occur, such as rapid breathing, gasping, wheezing, hives, skin rashes, puffy eyelids, and/or rapid heart beat occur.

If you develop vision abnormalities.

If you develop dizziness, depression, or confusion.

If you develop yellowing of the eyes that could indicate liver injury (although liver injury is rare and your liver function is checked when you have standard chemistry blood tests, which should be done periodically, when you are taking an NSAID).

If your urine becomes cloudy or bloody, the amount of urine you pass should suddenly decrease, or you develop new ankle swelling, all of which could indicate kidney problems. This is especially important to watch for if your kidney function has been noted, on lab testing, to have been abnormal in the past.

When to Call Your Doctor About Changing Dosage or Medications

If you develop swelling of the ankles or sudden weight gain after starting one of these drugs due to fluid retention.

If you develop decreased hearing or ringing in your ears.

If you are planning to get pregnant, or become pregnant.

Toradol

- Side Effects Center
- Drug Description
- Indications & Dosage
- Side Effects & Drug Interactions
- Warnings & Precautions
- Overdosage & Contraindications
- Clinical Pharmacology
- Medication Guide
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- NSAIDs (Nonsteroidal Antiinflammatory Drugs)
- Pain Management Medication Types
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Toradol User Reviews >>

A A A

Toradol

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Back Pain Slideshow: Myths and Facts

Chronic Pain Slideshow

Please Note: This Brand Name drug is no longer available in the US. (Generic versions may still be available.)

Patient Information Clinician Information

Toradol Side Effects Center

FACEBOOK TWITTER EMAIL PRINT

Medical Editor: Charles Patrick Davis, MD, PhD

Last reviewed on RxList 8/31/2016

Toradol (ketorolac tromethamine) is a nonsteroidal anti-inflammatory drug (NSAID) that is used to treat moderately severe pain and inflammation, usually after surgery. Toradol works by blocking the production of prostaglandins, compounds that cause pain, fever, and inflammation. The brand name Toradol is no longer available in the U.S. Generic versions may be available. Common side effects of Toradol include:

- headache,

Prescribing Information

- Drug Description
- Indications & Dosage
- Side Effects & Drug Interactions
- Warnings & Precautions
- Overdosage & Contraindications
- Clinical Pharmacology
- Medication Guide

For Patients

- heartburn,
- upset stomach,
- nausea,
- vomiting,
- diarrhea,
- stomach pain,
- bloating,
- gas,
- constipation,
- dizziness,
- drowsiness,
- sweating,
- and ringing in the ears.

Toradol is available as a 10 mg tablet and a solution (30 mg per ml) for intravenous (IV) or intramuscular (IM) administration. Toradol solution is administered as a single 15- to 60-mg dose once every 6 hours not to exceed 60 or 120 mg a day. The recommended oral dose is one to two Toradol tablets initially followed by one tablet every 4-6 hours, not to exceed 40 mg daily. Toradol should not be used for more than 5 days. Drug interactions may occur with lithium, ACE inhibitors, warfarin, and medications used to treat high uric acid levels. Warnings may apply to individuals who have ulcers, cardiovascular disease, kidney disease, and bleeding disorders. People who are taking aspirin or NSAIDs should not take Toradol because of the cumulative risk of inducing serious NSAID-related side effects. Toradol is generally avoided during pregnancy. Pregnant women may take Toradol only if it is clearly needed and the potential benefit justifies the potential risk to the fetus. Nursing mothers should not take Toradol, because it is excreted in breast milk. Toradol solution may be used as a single dose in children in certain instances, but safety and effectiveness in the pediatric population is not established.

Our Toradol Side Effects Drug Center provides a comprehensive view of available drug information on the potential side effects when taking this medication.

This is not a complete list of side effects and others may occur. Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

Toradol in Detail - Patient Information: Side Effects

Get emergency medical help if you have any of these **signs of an allergic reaction:** hives; difficulty breathing; swelling of your face, lips, tongue, or throat.

Stop taking ketorolac and seek medical attention or call your doctor at once if you have any of these serious side effects:

- chest pain, weakness, shortness of breath, slurred speech, problems with vision or balance;
- black, bloody, or tarry stools;
- coughing up blood or vomit that looks like coffee grounds;
- swelling or rapid weight gain;
- urinating less than usual or not at all;
- nausea, stomach pain, low fever, loss of appetite, dark urine, clay-colored stools, jaundice (yellowing of the skin or eyes);
- fever, sore throat, and headache with a severe blistering, peeling, and red skin rash;
- the first sign of any mouth sores or skin rash, no matter how mild;
- pale skin, easy bruising, severe tingling, numbness, pain, muscle weakness; or
- fever, headache, neck stiffness, chills, increased sensitivity to light, purple spots on the skin, and/or seizure (convulsions).

Less serious side effects may include:

- Toradol Overview
- Toradol in Detail with Side Effects

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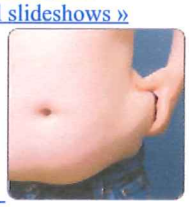

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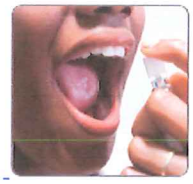

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Toradol

Rise in Illegal Fentanyl Linked to Overdoses »

"Medscape Medical News
Pauline Anderson
August 26, 2016

The increasing distribution of illicitly manufactured fentanyl (IMF) across the United States, and the sharp rise in overdose deaths linked to this drug, are causing m"...

Read the Rise in Illegal Fentanyl Linked to Overdoses article »

- upset stomach, mild nausea or vomiting, diarrhea, constipation;
- mild heartburn, stomach pain, bloating, gas;
- dizziness, headache, drowsiness;
- sweating; or
- ringing in your ears.

This is not a complete list of side effects and others may occur. Tell your doctor about any unusual or bothersome side effect. You may report side effects to FDA at 1-800-FDA-1088.

Read the entire detailed patient monograph for Toradol (Ketorolac Tromethamine)

Learn More »

Toradol Overview - Patient Information: Side Effects

SIDE EFFECTS: See also Warning section.
Upset stomach, nausea, vomiting, constipation, diarrhea, gas, dizziness, or drowsiness may occur. If any of these effects persist or worsen, tell your doctor or pharmacist promptly.

Remember that your doctor has prescribed this medication because he or she has judged that the benefit to you is greater than the risk of side effects. Many people using this medication do not have serious side effects.

Tell your doctor immediately if any of these unlikely but serious side effects occur: fainting, fast/pounding heartbeat, hearing changes (such as ringing in the ears), mental/mood changes (such as confusion, depression), persistent/severe headache, stomach pain, sudden/unexplained weight gain, swelling of the hands or feet, vision changes (such as blurred vision), unusual tiredness.

Tell your doctor immediately if any of these rare but serious side effects occur: easy bruising/bleeding, change in amount of urine, signs of infection (such as fever, chills, persistent sore throat), symptoms of meningitis (such as unexplained stiff neck, fever).

This drug may rarely cause serious (possibly fatal) liver disease. Seek immediate medical attention if you have any symptoms of liver damage, including: dark urine, stomach/abdominal pain, persistent nausea/vomiting, yellowing eyes/skin.

A very serious allergic reaction to this drug is rare. However, seek immediate medical attention if you notice any symptoms of a serious allergic reaction, including: rash, itching/swelling (especially of the face/tongue/throat), severe dizziness, trouble breathing.

This is not a complete list of possible side effects. If you notice other effects not listed above, contact your doctor or pharmacist.

In the US -

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

In Canada - Call your doctor for medical advice about side effects. You may report side effects to Health Canada at 1-866-234-2345.

Read the entire patient information overview for Toradol (Ketorolac Tromethamine)

Learn More »

Toradol FDA Prescribing Information: Side Effects (Adverse Reactions)

SIDE EFFECTS

Adverse reaction rates increase with higher doses of TORADOL (ketorolac tromethamine) . Practitioners should be alert for the severe complications of treatment with TORADOL (ketorolac tromethamine) , such as GI ulceration, bleeding and perforation, postoperative bleeding, acute renal failure, anaphylactic and anaphylactoid reactions and liver failure (see **BOXED**

WARNING, **WARNINGS**, **PRECAUTIONS**, and **DOSAGE AND ADMINISTRATION**). These NSAID-related complications can be serious in certain patients for whom TORADOL (ketorolac tromethamine) is indicated, especially when the drug is used inappropriately.

In patients taking TORADOL (ketorolac tromethamine) or other NSAIDs in clinical trials, the most frequently reported adverse experiences in approximately 1% to 10% of patients are:

GASTROINTESTINAL (GI) EXPERIENCES INCLUDING:		
abdominal pain*	constipation/diarrhea	dyspepsia*
flatulence	GI fullness	GI ulcers (gastric/duodenal)
gross bleeding/perforation	Heartburn	nausea*
stomatitis	Vomiting	
OTHER EXPERIENCES:		
abnormal renal function	Anemia	dizziness
drowsiness	Edema	elevated liver enzymes
headaches*	Hypertension	increased bleeding time
injection site pain	Pruritus	purpura
rashes	Tinnitus	sweating
*Incidence greater than 10%		

Additional adverse experiences reported occasionally (< 1% in patients taking TORADOL (ketorolac tromethamine) or other NSAIDs in clinical trials) include:

Body as a Whole: fever, infections, sepsis

Cardiovascular: congestive heart failure, palpitation, pallor, tachycardia, syncope

Dermatologic: alopecia, photosensitivity, urticaria

Gastrointestinal: anorexia, dry mouth, eructation, esophagitis, excessive thirst, gastritis, glossitis, hematemesis, hepatitis, increased appetite, jaundice, melena, rectal bleeding

Hemic and Lymphatic: ecchymosis, eosinophilia, epistaxis, leukopenia, thrombocytopenia

Metabolic and Nutritional: weight change

Nervous System: abnormal dreams, abnormal thinking, anxiety, asthenia, confusion, depression, euphoria, extrapyramidal symptoms, hallucinations, hyperkinesis, inability to concentrate, insomnia, nervousness, paresthesia, somnolence, stupor, tremors, vertigo, malaise

Reproductive, female: infertility

Respiratory: asthma, cough, dyspnea, pulmonary edema, rhinitis

Special Senses: abnormal taste, abnormal vision, blurred vision, hearing loss

Urogenital: cystitis, dysuria, hematuria, increased urinary frequency, interstitial nephritis, oliguria/polyuria, proteinuria, renal failure, urinary retention

Other rarely observed reactions (reported from postmarketing experience in patients taking TORADOL (ketorolac tromethamine) or other NSAIDs) are:

Body as a Whole: angioedema, death, hypersensitivity reactions such as anaphylaxis, anaphylactoid reaction, laryngeal edema, tongue edema (see **WARNINGS**), myalgia

Cardiovascular: arrhythmia, bradycardia, chest pain, flushing, hypotension, myocardial infarction, vasculitis

Dermatologic: exfoliative dermatitis, erythema multiforme, Lyell's syndrome, bullous reactions including Stevens-Johnson syndrome and toxic epidermal necrolysis

Gastrointestinal: acute pancreatitis, liver failure, ulcerative stomatitis, exacerbation of inflammatory bowel disease (ulcerative colitis, Crohn's disease)

Hemic and Lymphatic: agranulocytosis, aplastic anemia, hemolytic anemia, lymphadenopathy, pancytopenia, postoperative wound hemorrhage (rarely requiring blood transfusion - see **BOXED WARNING**, **WARNINGS**, and **PRECAUTIONS**)

Metabolic and Nutritional: hyperglycemia, hyperkalemia, hyponatremia

Nervous System: aseptic meningitis, convulsions, coma, psychosis

Respiratory: bronchospasm, respiratory depression, pneumonia

Special Senses: conjunctivitis

Urogenital: flank pain with or without hematuria and/or azotemia, hemolytic uremic syndrome

Postmarketing Surveillance Study

A large postmarketing observational, nonrandomized study, involving approximately 10,000 patients receiving ketorolac tromethamine$^{IV/IM}$, demonstrated that the risk of clinically serious gastrointestinal (GI) bleeding was dose-dependent (see Tables 3A and 3B). This was particularly true in elderly patients who received an average daily dose greater than 60 mg/day of ketorolac tromethamine$^{IV/IM}$ (see Table 3A).

Table 3 Incidence of Clinically Serious GI Bleeding as Related to Age, Total Daily Dose, and History of GI Perforation, Ulcer, Bleeding (PUB) After up to 5 Days of Treatment With Ketorolac Tromethamine$^{IV/IM}$A.

A. ADULT PATIENTS WITHOUT HISTORY OF PUB

AGE OF PATIENTS	TOTAL DAILY DOSE OF KETOROLAC TROMETHAMINEIV/IM			
	≤ 60 MG	> 60 TO 90 MG	> 90 TO 120 MG	> 120 MG
< 65 years of age	0.4%	0.4%	0.9%	4.6%
≥ 65 years of age	1.2%	2.8%	2.2%	7.7%

B. ADULT PATIENTS WITH HISTORY OF PUB

AGE OF PATIENTS	TOTAL DAILY DOSE OF KETOROLAC TROMETHAMINEIV/IM			
	≤ 60 MG	> 60 TO 90 MG	> 90 TO 120 MG	> 120 MG
< 65 years of age	2.1%	4.6%	7.8%	15.4%
≥ 65 years of age	4.7%	3.7%	2.8%	25.0%

Read the entire FDA prescribing information for Toradol (Ketorolac Tromethamine)

Read More »

Related Resources for Toradol

Related Health

- NSAIDs (Nonsteroidal Antiinflammatory Drugs)
- Pain Management Medication Types

UW Health
Pain Care Services
uwhealth.org/pain

Pain Care Fast Facts: 5-Minute Clinical Inservice

Respiratory Depression from Opioids

3rd Ed,12/08

Opioid analgesics depress respiration primarily by reducing responsiveness of the brain-stem respiratory centers to carbon dioxide (CO_2). Therapeutic doses depress all phases of respiratory activity (rate, minute volume and tidal exchange) and may produce irregular breathing. The diminished respiratory volume is primarily due to a slower rate of breathing. Natural sleep produces a decrease in sensitivity to CO_2; the effects of opioids and sleep are additive. When CO_2 accumulates it stimulates central chemoreceptors resulting in a compensatory increase in respiratory rate that can mask the degree of respiratory depression. Therefore, respiratory rate is not a reliable indicator of the degree of respiratory depression.

Opioids depress all phases of respiratory activity including:
- Rate
- Minute volume
- Tidal exchange
- Rhythm

Clinically significant respiratory depression rarely occurs with standard opioid doses in the absence of underlying pulmonary dysfunction. Patients at greater risk for respiratory depression include infants less than 6 months old, opioid-naïve patients, the elderly, and those who have coexisting conditions such as chronic pulmonary disease and major organ failure, or are receiving other CNS depressants. **The combination of opioids with general anesthetics, alcohol, and sedative-hypnotics such as benzodiazepines and antihistamines enhance the risk of respiratory depression.** When respiratory depression occurs, it is usually in opioid-naïve individuals after acute administration of an opioid and is preceded by other signs of CNS depression such as sedation and mental clouding.

UWHC Adult Sedation Assessment Scale

N= Normal Sleep
1 = Anxious, agitated or restless
2 = Calm, cooperative to tranquil (normal baseline without sedation)
3 = Quiet, drowsy, responds to verbal commands
4 = Asleep, brisk response to forehead tap or loud verbal stimuli
5 = Asleep, sluggish response to increasingly vigorous stimuli
6 = Unresponsive to painful stimuli
[Moderate Sedation = Sedation Score of 4]
If caring for children, use the Pediatric Sedation Scale

Nursing observation is the best method for monitoring sedation level and respiratory status. Use an age appropriate Sedation Assessment Scale (See box) to monitor sedation level. When possible, the same nurse within a shift should obtain the required serial sedation assessments to better detect signs of progressive sedation. Special monitoring, such as pulse oximetry, is warranted only if required by preexisting conditions and may warn of significant depression too late. Care must be taken in the interpretation of any pulse oximetry readings. If the patient is receiving supplemental oxygen the added oxygen may mask deterioration in respiratory function. In addition, unless continuous pulse oximetry is used, episodic hypoxemia may be missed.

Treatment

Detection and initial treatment of clinically significant respiratory depression involve nursing observation, decreasing the opioid dose when excessive sedation is detected, rousing the patient, administering oxygen and asking the patient to take deep breaths. No patient has died from opioid-induced respiratory depression while awake.

Naloxone, an opioid antagonist, is indicated in the presence of a sedation score of 5 combined with a respiratory rate less than 8/min. It should be titrated carefully. Giving too much naloxone or giving it too fast can precipitate severe pain that is extremely difficult to control and increase sympathetic activity leading to hypertension, tachycardia, ventricular dysrhythmias, pulmonary edema and cardiac arrest. In physically dependent patients, withdrawal syndrome can be precipitated. Naloxone may precipitate seizures in patients receiving meperidine. **The goal of reversal is to achieve a level of consciousness that sustains respirations. Naloxone should be administered in individual doses of 0.1mg (100 mcg) or less IV push while the patient is continuously monitored (pediatric dose 1-2 mcg/kg).** Patients who are comatose should be endotracheally intubated to protect the airway and allow positive pressure ventilation. Doses of naloxone may be repeated every 3-5 minutes until an adequate level of consciousness is achieved. Naloxone has a shorter half-life and duration (~1 hour) than most opioids and may need to be re-administered (or, rarely, given as a continuous infusion (1-2 mcg/kg/hour).

When naloxone is necessary, continuous monitoring is required with documentation every 15 min per Policy #8.38 (Adult Sedation) for a minimum of 2 hours or until the patient returns to baseline, whichever is later. This is also considered an adverse event and an occurrence screen should be completed via the Patient Safety Network (PSN).

References:

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Volvulus

From Wikipedia, the free encyclopedia

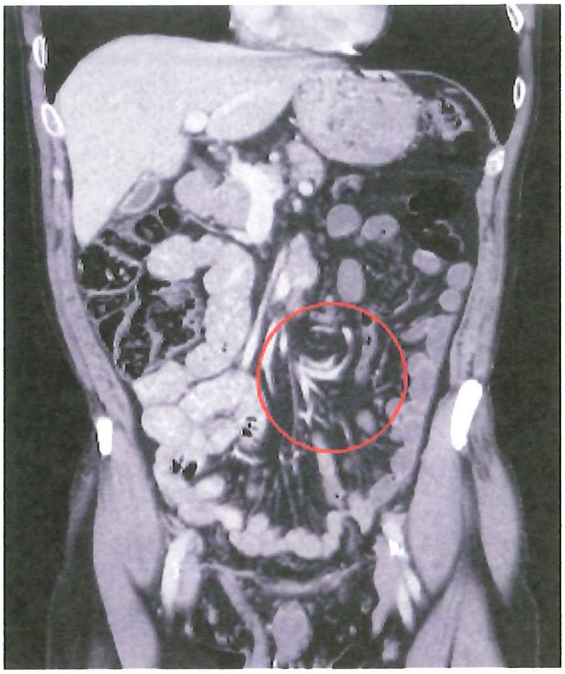
A **volvulus** is when a loop of intestine twists around itself and the mesentery that supports it, resulting in a bowel obstruction.[1] Symptoms include abdominal pain, abdominal bloating, vomiting, constipation, and bloody stool.[1][2] Onset of symptoms may be rapid or more gradual.[2] The mesentery may become so tightly twisted that blood flow to part of the intestine is cut off, resulting in ischemic bowel.[1] In this situation there may be fever or significant pain when the abdomen is touched.[2]

Risk factors include a birth defect known as intestinal malrotation, an enlarged colon, Hirschsprung disease, pregnancy, and abdominal adhesions.[1] Long term constipation and a high fiber diet may also increase the risk.[3] The most commonly affected part of the intestines in adults is the sigmoid colon with the cecum being second most affected.[1] In children the small intestine is more often involved.[4] The stomach can also be affected.[5] Diagnosis is typically with medical imaging such as plain X-rays, a GI series, or CT scan.[1]

Initial treatment for sigmoid volvulus may occasionally occur via sigmoidoscopy or with a barium enema. Due to the high risk of recurrence, a bowel resection within the next two days is generally recommended.[3] If the bowel is severely twisted or the blood supply is cut off, immediate surgery is required.[1] In a cecal volvulus, often part of the bowel needs to be surgically removed.[3] If the cecum is still healthy, it may occasionally be returned to a normal position and sutured in place.[1][3]

Cases of volvulus were described in ancient Egypt as early as 1550 BC. It occurs most frequently in Africa, the Middle East, and India.[3] Rates of volvulus in the United States are about 2-3 per 100,000 people per year.[6][2] Sigmoid and cecal volvulus typically occurs between the ages of 30 and 70.[1][7] Outcomes are related to whether or not the bowel tissue has died.[2] The term volvulus is from the Latin "volvere"; which means "to roll".[3]

Volvulus



Coronal CT of the abdomen, demonstrating a volvulus as indicated by twisting of the bowel stock

Classification and external resources

Specialty	General surgery
ICD-10	K56.2 (http://apps.who.int/classifications/icd10/browse/2016/en#/K56.2)
ICD-9-CM	537.3 (http://www.icd9data.com/getICD9Code.ashx?icd9=537.3), 560.2 (http://www.icd9data.com/getICD9Code.ashx?icd9=560.2)
DiseasesDB	13996 (http://www.diseasesdatabase.com/ddb13996.htm)
eMedicine	ped/2415 (http://www.emedicine.com/ped/topic2415.htm)
MeSH	D045822 (https://www.nlm.nih.gov/cgi/mesh/2016/MB_cgi?field=uid&term=D045822)

Contents

Signs and symptoms

Regardless of cause, volvulus causes symptoms by two mechanisms:

- Bowel obstruction manifested as abdominal distension and bilious vomiting.
- Ischemia (loss of blood flow) to the affected portion of intestine.

Depending on the location of the volvulus, symptoms may vary. For example, in patients with a cecal volvulus, the predominant symptoms may be those of a small bowel obstruction (nausea, vomiting and lack of stool or flatus), because the obstructing point is close to the ileocecal valve and small intestine. In patients with a sigmoid volvulus, although abdominal pain may be present, symptoms of constipation may be more prominent.

Volvulus causes severe pain and progressive injury to the intestinal wall, with accumulation of gas and fluid in the portion of the bowel obstructed.[8] Ultimately, this can result in necrosis of the affected intestinal wall, acidosis, and death. This is known as a closed loop obstruction because there exists an isolated ("closed") loop of bowel. Acute volvulus often requires immediate surgical intervention to untwist the affected segment of bowel and possibly resect any unsalvageable portion.[8]

Volvulus occurs most frequently in middle-aged and elderly men.[8] Volvulus can also arise as a rare complication in persons with redundant colon, a normal anatomic variation resulting in extra colonic loops.[9]

Sigmoid volvulus is the most-common form of volvulus of the gastrointestinal tract.[10] and is responsible for 8% of all intestinal obstructions. Sigmoid volvulus is particularly common in elderly persons and constipated patients. Patients experience abdominal pain, distension, and absolute constipation.

Cecal volvulus is slightly less common than sigmoid volvulus and is associated with symptoms of abdominal pain and small bowel obstruction.

Volvulus can also occur in patients with Duchenne muscular dystrophy due to the smooth muscle dysfunction.

Causes

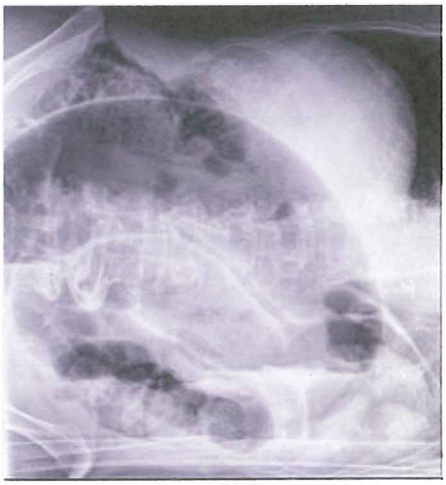
Midgut volvulus occurs in people (usually babies) that are predisposed because of congenital intestinal malrotation. Segmental volvulus occurs in people of any age, usually with a predisposition because of abnormal testinal contents (e.g. meconium ileus) or adhesions. Volvulus of the cecum, transverse colon, or sigmoid colon occurs, usually in adults, with only minor predisposing factors such as redundant (excess, inadequately supported) intestinal tissue and constipation.

Types

- volvulus neonatorum
- volvulus of the small intestine
- volvulus of the caecum (cecum), also cecal volvulus
- sigmoid colon volvulus (sigmoid volvulus)
- volvulus of the transverse colon
- volvulus of the splenic flexure, the rarest
- gastric volvulus
- ileosigmoid knotting

Diagnosis

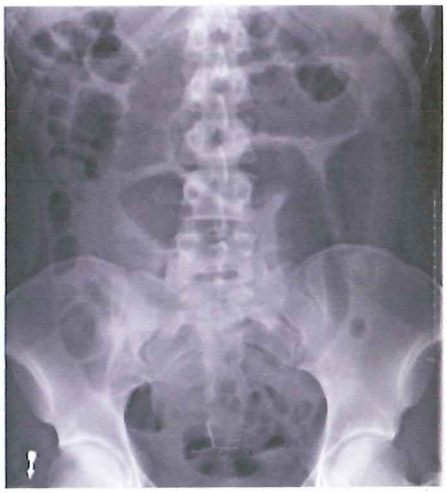
After taking a thorough history, the diagnosis of colonic volvulus is usually easily included in the differential diagnosis. Abdominal plain x-rays are commonly confirmatory for a volvulus, especially if a "bent inner tube" sign or a "coffee bean" sign are seen. These refer to the shape of the air filled closed loop of colon which forms the volvulus. Should the diagnosis be in doubt, a barium enema may be used to demonstrate a "bird's beak" at the point where the segment of proximal bowel and distal bowel rotate to form the volvulus. This area shows an acute and sharp tapering and looks like a bird's beak. If a perforation is suspected, barium should not be used due to its potentially lethal effects when distributed throughout the free infraperitoneal cavity. Gastrografin, which is safer, can be substituted for barium.



Coffee bean sign in a patient with sigmoid volvulus

The differential diagnosis includes the much more common constricting or obstructing carcinoma. In approximately 80 percent of colonic obstructions, an invasive carcinoma is found to be the cause of the obstruction. This is usually easily diagnosed with endoscopic biopsies.

Diverticulitis is a common condition with different presentations. Although diverticulitis may be the source of a colonic obstruction, it more commonly causes an ileus, which appears to be a colonic obstruction.[11] Endoscopic means can be used to secure a diagnosis although this may cause a perforation of the inflamed diverticular area. CT scanning is the more common method to diagnose diverticulitis. The scan will show mesenteric stranding in the involved segment of edematous colon which is usually in the sigmoid region. Micro perforations with free air may be seen.



An x-ray of a person with a small bowel volvulus.

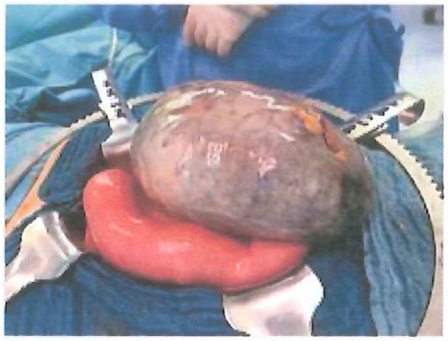
Ulcerative colitis or Crohn's disease may cause colonic obstruction. The obstruction may be acute or chronic after years of uncontrolled disease leads to the formation of strictures and fistulas . The medical history is helpful in that most cases of inflammatory bowel disease are well known to both patient and doctor.

Other rare syndromes, including Ogilvie's syndrome, chronic constipation and impaction may cause a pseudo obstruction.[12]

- Abdominal x-ray – tire-like shadow arising from right iliac fossa and passing to left
- Upper GI series

Treatment

Sigmoid volvulus



Volvulus with gangrene of the sigmoid

Treatment for sigmoid volvulus may include sigmoidoscopy. If the mucosa of the sigmoid looks normal and pink, place a rectal tube for decompression, correct any fluid, electrolyte, cardiac, renal or pulmonary abnormalities and then take the person to the operating room for repair. If surgery is not performed, there is a high rate of recurrence.

For people with signs of sepsis or an abdominal catastrophe, immediate surgery and resection is advised.

Cecal volvulus

In a cecal volvulus, the cecum may be returned to a normal position and sutured in place, a procedure known as cecopexy.[1]

Other

Laparotomy for other forms of volvulus, especially anal volvulus.

Complications

- Strangulation
- Gangrene
- Perforation
- Faecal peritonitis
- Recurrent volvulus

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External links

- CT of an abdomen with sigmoid volvulus (http://www.claripacs.com/case/CL0013)

Wikimedia Commons has media related to ***Volvulus***.

Categories: Diseases of intestines | Abdominal pain

URL of this page: //medlineplus.gov/ency/article/003133.htm

Gastrointestinal bleeding

Gastrointestinal (GI) bleeding refers to any bleeding that starts in the gastrointestinal tract.

Bleeding may come from any site along the GI tract, but is often divided into:

- Upper GI bleeding: The upper GI tract includes the esophagus (the tube from the mouth to the stomach), stomach, and first part of the small intestine.
- Lower GI bleeding: The lower GI tract includes much of the small intestine, large intestine or bowels, rectum, and anus.

Considerations

The amount of GI bleeding may be so small that it can only be detected on a lab test such as the fecal occult blood test. Other signs of GI bleeding include:

- Dark, tarry stools
- Larger amounts of blood passed from the rectum
- Small amounts of blood in the toilet bowl, on toilet paper, or in streaks on stool (feces)
- Vomiting blood

Massive bleeding from the GI tract can be dangerous. However, even very small amounts of bleeding that occur over a long period of time can lead to problems such as anemia or low blood counts.

Once a bleeding site is found, many therapies are available to stop the bleeding or treat the cause.

Causes

GI bleeding may be due to conditions that are not serious, including:

- Anal fissure
- Hemorrhoids

GI bleeding may also be a sign of more serious diseases and conditions. These may include cancers of the GI tract such as:

- Cancer of the colon
- Cancer of the small intestine
- Cancer of the stomach
- Intestinal polyps (a pre-cancerous condition)

Other causes of GI bleeding may include:

- Abnormal blood vessels in the lining of the intestines (also called angiodysplasia)
- Bleeding diverticulum, or diverticulosis
- Crohn's disease or ulcerative colitis
- Esophageal varices
- Esophagitis
- Gastric (stomach) ulcer
- Intussusception (bowel telescoped on itself)
- Mallory-Weiss tear
- Meckel's diverticulum
- Radiation injury to the bowel

Home Care

There are home stool tests for microscopic blood that may be recommended for people with anemia or for colon cancer screening.

When to Contact a Medical Professional

Call your health care provider if:

- You have black, tarry stools (this may be a sign of GI bleeding)
- You have blood in your stool
- You vomit blood or you vomit material that looks like coffee grounds

What to Expect at Your Office Visit

Your provider may discover GI bleeding during an exam at your office visit.

GI bleeding can be an emergency condition that requires immediate medical care. Treatment may involve:

- Blood transfusions
- Fluids and medicines through a vein
- Esophagogastroduodenoscopy (EGD). A thin tube with a camera on the end is passed through your mouth into your esophagus, stomach, and small intestine
- A tube is placed through your mouth into the stomach to drain the stomach contents (gastric lavage)

Once your condition is stable, you will have a physical exam and a detailed exam of your abdomen. You will also be asked questions about your symptoms, including:

- When did you first notice symptoms?
- Did you have black, tarry stools or red blood in the stools?
- Have you vomited blood?
- Did you vomit material that looks like coffee grounds?
- Do you have a history of peptic or duodenal ulcers?
- Have you ever had symptoms like this before?
- What other symptoms do you have?

Tests that may be done include:

- Abdominal CT scan
- Abdominal MRI scan
- Abdominal x-ray
- Angiography
- Bleeding scan (tagged red blood cell scan)
- Blood clotting tests
- Capsule endoscopy (camera pill that is swallowed to look at the small intestine)
- Colonoscopy
- Complete blood count (CBC), clotting tests, platelet count, and other laboratory tests
- Enteroscopy
- Sigmoidoscopy

Alternative Names

Lower GI bleeding; GI bleeding; Upper GI bleeding

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Update Date 1/11/2015

Updated by: Todd Eisner, MD, Private practice specializing in Gastroenterology, and Affiliate Assistant Professor, Florida Atlantic University School of Medicine, Boca Raton, FL. Review provided by VeriMed Healthcare Network. Also reviewed by David Zieve, MD, MHA, Isla Ogilvie, PhD, and the A.D.A.M. Editorial team.

Negative Effects of Condition(DMD)

- Completely immobile and dependent on others for everything
- Severe Contractures
- Joint stiffness and pain
- Muscle spasms and cramps
- Restless legs
- Overall stiffness
- Nerve pain in hips, legs, and feet
- Loss of speech
- Difficulty swallowing
- Severely compromised respiratory function requiring 24/7 respiratory support
- Weakened Cardiac function requiring a Pacemaker
- Inability to eat due to a recurring twisted bowel or Volvulus as a result of DMD
- Nausea
- Heartburn
- Indigestion
- Slight GI bleed from unknown source
- Require 24/7 TPN(Total Parental Nutrition) for nutrition
- Severe abdominal pain, cramping, and bloating due to recurring Volvulus
- Incontinence
- Anxiety
- Depression
- Insomnia
- Fatigue

Negative Effects of Current Treatments

- Toradol and other NSAID's cause serious GI side effects such as GI bleeding which only exasperates the GI conditions of Volvulus, Nausea, Heartburn, Indigestion, and existing GI bleed of unknown source
- All Opioids cause respiratory depression and would certainty cause further distress and potentially be life threatening
- Massage proving ineffective for relief of my condition
- Current treatments are severely limited and lacking in effectiveness

Clinical Crossroads

Medical Marijuana for Treatment of Chronic Pain and Other Medical and Psychiatric Problems
A Clinical Review

Kevin P. Hill, MD, MHS

Editorial page 2431

Related articles page 2456 and page 2491 and JAMA Patient Page page 2508

Supplemental content at jama.com

CME Quiz at jamanetworkcme.com and CME Questions page 2489

IMPORTANCE As of March 2015, 23 states and the District of Columbia had medical marijuana laws in place. Physicians should know both the scientific rationale and the practical implications for medical marijuana laws.

OBJECTIVE To review the pharmacology, indications, and laws related to medical marijuana use.

EVIDENCE REVIEW The medical literature on medical marijuana was reviewed from 1948 to March 2015 via MEDLINE with an emphasis on 28 randomized clinical trials of cannabinoids as pharmacotherapy for indications other than those for which there are 2 US Food and Drug Administration–approved cannabinoids (dronabinol and nabilone), which include nausea and vomiting associated with chemotherapy and appetite stimulation in wasting illnesses.

FINDINGS Use of marijuana for chronic pain, neuropathic pain, and spasticity due to multiple sclerosis is supported by high-quality evidence. Six trials that included 325 patients examined chronic pain, 6 trials that included 396 patients investigated neuropathic pain, and 12 trials that included 1600 patients focused on multiple sclerosis. Several of these trials had positive results, suggesting that marijuana or cannabinoids may be efficacious for these indications.

CONCLUSIONS AND RELEVANCE Medical marijuana is used to treat a host of indications, a few of which have evidence to support treatment with marijuana and many that do not. Physicians should educate patients about medical marijuana to ensure that it is used appropriately and that patients will benefit from its use.

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Section Editor: Edward H. Livingston, MD, Deputy Editor, *JAMA*.

This article is based on a conference that took place at the Medicine Grand Rounds at Beth Israel Deaconess Medical Center, Boston, Massachusetts, on May 16, 2014.

Dr Burns Mr Z is a 60-year-old man who fell at work 19 years ago and has had chronic low back pain and left leg radicular symptoms since that time. None of the numerous interventions performed in an effort to treat this pain were effective. These include an L2-3 laminectomy in 1996, multiple lumbar epidural steroid injections, selective nerve root blocks, lidocaine infusions, and a trial of a spinal cord stimulator. He has been to a pain psychologist and received physical therapy. Several medications have helped, such as gabapentin, sertraline, and nortriptyline.

His most recent magnetic resonance imaging scan showed posterior disk bulges at L2-3, L3-4, L4-5, and L5-S1, with the largest bulge at L2-3. Mild effacement of the thecal sac and narrowing of the left-sided neural foramina were seen. Mr Z was diagnosed as having failed back syndrome (chronic back pain following a laminectomy) and treated with long-term narcotics. He signed a narcotics contract with his primary care physician and has never violated the contract. Since signing his narcotics contract, Mr Z has decreased his narcotic requirements and is now taking oxycodone, 10 mg, along with ibuprofen, 600 mg, every 6 hours.

Because his overall goal remains pain relief, he has recently begun using marijuana. He received a recommendation from a cannabis clinic, a clinic whose primary function is to certify patients for the use of medical marijuana, but is now wondering if this is something his primary care physician could also agree with and therefore be responsible for the recommendation of in the future. He uses marijuana at home in the evening after returning from work. He has found marijuana to have a sedative effect, enabling him to get a good night's sleep and to have less pain the next day.

Mr Z's medical history is notable for hyperlipidemia, prediabetes, basal cell carcinoma, and anxiety. His other medications include bupropion, 150-mg sustained-release tablet twice daily; clonazepam, 0.5 mg twice daily as needed; and simvastatin, 20 mg once daily. Previously he was received disability benefits but currently works as an arborist. He drinks alcohol socially and continues to smoke cigarettes, although he has been able to cut down from 1½

packs to a half pack daily since starting bupropion. He lives at home with his adult son.

Mr Z: His View

My first experience with what would later blossom into chronic pain was about 3 weeks postsurgically after I had the L2-3 and L4-5 levels of my back worked on. Since then, I went through everything from cortisone shots to lidocaine infusions. I actually had a test for the spinal cord stimulator and there was even talk about an intrathecal morphine pump. I totally exhausted every option that was there, and my final procedure was going to be a lysis of spinal adhesions.

When I first went through my medical requirements and was screened by the doctor, I told her that it really was not a matter of needing a lot of it, as I was going to use it at home after work. So there was no question of still being under its influence at any point in time where I would be going to work or driving. I felt that my medical history alone warranted at least my looking at it as an alternative medication. The [Massachusetts 2012 medical marijuana] ballot initiative made me more comfortable with my decision.

Search Methods and Results

Dr Hill Mr Z is a 60-year-old man with a long history of chronic low back pain refractory to multiple procedures and medications. In an effort to obtain better control of his chronic pain, he began using medical marijuana after receiving a certification from a local specialty medical marijuana clinic. He thought that medical marijuana improved his pain control and approached his primary care physician about continued use of medical marijuana.

The medical literature on medical marijuana was searched from 1948 to March 2015 using MEDLINE. The search terms used included *cannabis*, *cannabinoids*, and *tetrahydrocannabinol*. The limits used were "administration and dosage" "adverse effects" "therapeutic use," or "clinical trial." The MEDLINE search resulted in 562 articles. Articles that discussed cannabinoids as pharmacotherapy in a clinical trial were selected for an initial brief review. After additional citations were obtained from references, a total of 74 articles were reviewed. There are no meta-analyses on the topic of medical marijuana; there are 3 systematic reviews.[1-3] Similarly, there is only 1 set of guidelines that addresses the use of medical marijuana as a treatment.[4] As a result, the main emphasis was on randomized clinical trials.

Medical Marijuana: Scientific Rationale and Practical Implications

As of March 2015, 23 states and the District of Columbia have enacted medical marijuana laws to facilitate access to marijuana as a treatment for a variety of medical conditions (Table 1). This is concerning to some because marijuana is the most commonly used illicit drug in the United States: approximately 12% of people aged 12 years or older reported use in the past year, and use among teens has drifted upward in recent years while their perception of its risk has declined.[6,7] With decriminalization of medical marijuana and Washington, Colorado, Alaska, Oregon, and the District of Columbia legalizing the recreational use of marijuana, there has been an increase in marijuana use. As a result, physicians are increasingly faced with questions from patients about marijuana and its medical applications.[8]

Pharmacology of Marijuana

Marijuana comprises more than 60 pharmacologically active cannabinoids.[9] Both exogenous ligands, such as the cannabinoids from marijuana, and endogenous ligands or endocannabinoids, such as anandamide and 2-arachidonylglycerol, act on cannabinoid receptors located throughout the body but mostly in the brain and spinal cord.[10] Activation of 2 types of G protein–coupled receptors, CB1 and CB2, exerts multiple actions by directly inhibiting the release of multiple neurotransmitters including acetylcholine, dopamine, and glutamate while indirectly affecting γ-aminobutyric acid, *N*-methyl-D-aspartate, opioid, and serotonin receptors.[11] CB1 receptors are concentrated primarily in the basal ganglia, cerebellum, hippocampus, association cortices, spinal cord, and peripheral nerves and CB2 receptors are found mainly on cells in the immune system, which may in part explain cannabinoids' effects on pain and inflammation. The physiological responses that result from cannabinoid receptor activation are euphoria, psychosis, impaired memory and cognition, reduced locomotor function, increased appetite, and antiemetic, pain-relieving, antispasticity, and sleep-promoting effects.[3]

The primary cannabinoids contained in marijuana are Δ^9-tetrahydrocannabinol (THC) and cannabidiol. THC produces the euphoria that comes from using marijuana, but it also can produce psychosis. Cannabidiol is not psychoactive and is thought to have antianxiety and possibly antipsychotic effects as well.[12,13] Marijuana's therapeutic effects depend on the concentration of THC in a given formulation as well as the ratio of THC to cannabidiol because of cannabidiol's ability to mitigate the psychoactive effects of THC. As a result, the THC-cannabidiol ratio for many strains of marijuana has been engineered to achieve desired effects.

Medical Indications for Cannabinoids

There are currently 2 US Food and Drug Administration (FDA)–approved cannabinoids available in the United States: dronabinol and nabilone.[14,15] Both are available in pill form and are FDA approved for nausea and vomiting associated with cancer chemotherapy as well as for appetite stimulation in wasting illnesses such as human immunodeficiency virus infection or cancer. Medical marijuana, which may be identical in form to recreational marijuana, is dried material from the *Cannabis* plant consisting of THC, cannabidiol, and other cannabinoids. Medical marijuana is purchased from dispensaries in a variety of preparations (Table 2) or grown by patients for the treatment of myriad illnesses. It is not available from pharmacies because of its status as federally illegal.

Table 1. Medical Marijuana Laws by State[a]

State	Approved Conditions	Legal Limit
Alaska, 1998	Cachexia, cancer, chronic pain, epilepsy and other disorders characterized by seizures, glaucoma, HIV/AIDS, MS and other disorders characterized by muscle spasticity, and nausea; other conditions are subject to approval by the Alaska Department of Health and Social Services	1 oz usable; 6 plants (3 mature, 3 immature)
Arizona, 2010	Cancer, glaucoma, HIV/AIDS, hepatitis C, ALS, Crohn disease, Alzheimer disease, cachexia, severe and chronic pain, severe nausea, seizures (including epilepsy), severe or persistent muscle spasms	2.5 oz usable; 0-12 plants
California, 1996	AIDS, anorexia, arthritis, cachexia, cancer, chronic pain, glaucoma, migraine, persistent muscle spasms (including spasms associated with MS), seizures (including seizures associated with epilepsy), severe nausea, other chronic or persistent medical symptoms	8 oz usable; 6 mature or 12 immature plants
Colorado, 2000	Cancer, glaucoma, HIV/AIDS, cachexia, severe pain, severe nausea, seizures (including those characteristic of epilepsy), persistent muscle spasms (including those characteristic of MS); other conditions are subject to approval by the Colorado Board of Health	2 oz usable; 6 plants (3 mature, 3 immature)
Connecticut, 2012	Cancer, glaucoma, HIV/AIDS, Parkinson disease, MS, damage to the nervous tissue of the spinal cord with objective neurological indication of intractable spasticity, epilepsy, cachexia, Crohn disease, PTSD, or any medical condition, medical treatment, or disease approved by the Department of Consumer Protection	1-mo supply (exact amount to be determined)
Washington, DC, 2010	HIV/AIDS, cancer, glaucoma, conditions characterized by severe and persistent muscle spasms such as MS, patients undergoing chemotherapy or radiotherapy or using azidothymidine or protease inhibitors	2 oz dried; limits on other forms to be determined
Delaware, 2011	Cancer, HIV/AIDS, decompensated cirrhosis (hepatitis C), ALS, Alzheimer disease A chronic or debilitating disease or medical condition or its treatment that produces ≥1 of the following: cachexia; severe, debilitating pain that has not responded to previously prescribed medication or surgical measures for more than 3 mo or for which other treatment options produced serious adverse effects; intractable nausea; seizures; severe and persistent muscle spasms including but not limited to those characteristic of MS	6 oz usable
Hawaii, 2000	Cancer, glaucoma, HIV/AIDS, a chronic or debilitating disease or medical condition or its treatment that produces cachexia, severe pain, severe nausea, seizures including those characteristic of epilepsy, or severe and persistent muscle spasms including those characteristic of MS or Crohn disease; other conditions are subject to approval by the Hawaii Department of Health	3 oz usable; 7 plants (3 mature, 4 immature)
Illinois, 2013	Cancer, glaucoma, HIV/AIDS, hepatitis C, ALS, Crohn disease, agitation related to Alzheimer disease, cachexia/wasting syndrome, muscular dystrophy, severe fibromyalgia, spinal cord disease (including but not limited to arachnoiditis), Tarlov cysts, hydromyelia syringomyelia, rheumatoid arthritis, fibrous dysplasia, spinal cord injury, traumatic brain injury and postconcussion syndrome, MS, Arnold-Chiari malformation and syringomelia, spinocerebellar ataxia, Parkinson disease, Tourette syndrome, myoclonus, dystonia, reflex sympathetic dystrophy (complex regional pain syndromes type 1), causalgia, complex regional pain syndrome type 2, neurofibromatosis, chronic inflammatory demyelinating polyneuropathy, Sjogren syndrome, lupus, interstitial cystitis, myasthenia gravis, hydrocephalus, nail patella syndrome or residual limb pain, or treatment of these conditions	2.5 ounces usable cannabis during 14-d period
Maine, 1999	Epilepsy and other disorders characterized by seizures, glaucoma, MS and other disorders characterized by muscle spasticity, and nausea or vomiting as a result of AIDS or cancer chemotherapy	2.5 oz usable; 6 plants
Maryland, 2014	Cachexia, anorexia, or wasting syndrome, severe or chronic pain, severe nausea, seizures, severe or persistent muscle spasms, or other conditions approved by the commission	30-d supply, amount to be determined
Massachusetts, 2012	Cancer, glaucoma, HIV/AIDS, hepatitis C, ALS, Crohn disease, Parkinson disease, MS, and other conditions as determined in writing by a qualifying patient's physician	60-d supply (10 oz) for personal medical use
Michigan, 2008	Cancer, glaucoma, HIV/AIDS, hepatitis C, ALS, Crohn disease, agitation of Alzheimer disease, nail patella syndrome, cachexia or wasting syndrome, severe and chronic pain, severe nausea, seizures, epilepsy, muscle spasms, MS, PTSD	2.5 oz usable; 12 plants
Minnesota, 2014	Cancer (if the underlying condition or treatment produces severe or chronic pain, nausea, severe vomiting, or cachexia or severe wasting), glaucoma, HIV/AIDS, Tourette syndrome, ALS, seizures/epilepsy, severe and persistent muscle spasms/MS, Crohn disease, terminal illness with a life expectancy of <1 y	30-d supply of nonsmokable marijuana
Montana, 2004	Cancer, glaucoma, HIV/AIDS, or the treatment of these conditions; cachexia or wasting syndrome, severe or chronic pain, severe nausea, seizures including those caused by epilepsy, severe or persistent muscle spasms including those caused by MS or Crohn disease, or any other medical condition or treatment for a medical condition adopted by the department by rule	1 oz usable; 4 plants (mature); 12 seedlings
Nevada, 2000	AIDS, cancer, glaucoma, and any medical condition or treatment for a medical condition that produces cachexia, persistent muscle spasms or seizures, severe nausea or pain, PTSD; other conditions are subject to approval by the health division of the state department of human resources	1 oz usable; 7 plants (3 mature, 4 immature)
New Hampshire, 2013	Cancer, glaucoma, HIV/AIDS, hepatitis C, ALS, muscular dystrophy, Crohn disease, agitation of Alzheimer disease, MS, chronic pancreatitis, spinal cord injury or disease, traumatic brain injury, or ≥1 injuries that significantly interferes with daily activities as documented by the patient's clinician; a severely debilitating or terminal medical condition or its treatment that has produced ≥1 of the following: elevated intraocular pressure, cachexia, chemotherapy induced anorexia, wasting syndrome, severe pain not responding to previously prescribed medication or surgical measures or for which other treatment options produced serious adverse effects, constant or severe nausea, moderate to severe vomiting, seizures, or severe, persistent muscle spasms	Two oz of usable cannabis during a 10-d period
New Jersey, 2010	Seizure disorder including epilepsy, intractable skeletal muscular spasticity, glaucoma, severe or chronic pain, severe nausea or vomiting, cachexia or wasting syndrome resulting from HIV/AIDS or cancer, ALS, MS, terminal cancer, muscular dystrophy, IBD including Crohn disease, terminal illness (physician-determined prognosis of <12 mo of life), or any other medical condition or its treatment approved by the Department of Health and Senior Services	2 oz usable
New Mexico, 2007	Severe chronic pain, painful peripheral neuropathy, intractable nausea/vomiting, severe anorexia/cachexia, hepatitis C, Crohn disease, PTSD, ALS, cancer, glaucoma, MS, damage to the nervous tissue of the spinal cord with intractable spasticity, epilepsy, HIV/AIDS, hospice care, cervical dystonia, inflammatory autoimmune-mediated arthritis, Parkinson disease, Huntington disease	6 oz usable; 16 plants (4 mature, 12 immature)

(continued)

Table 1. Medical Marijuana Laws by State[a] (continued)

State	Approved Conditions	Legal Limit
New York, 2014	Cancer, HIV/AIDS, ALS, Parkinson disease, MS, spinal cord damage causing spasticity, epilepsy, IBD, neuropathies, Huntington disease The Department of Health commissioner has the discretion to add or delete conditions and must decide whether to add Alzheimer disease, muscular dystrophy, dystonia, PTSD, and rheumatoid arthritis within 18 mo of the law becoming effective	30-d supply nonsmokable marijuana
Oregon, 1998	Cancer, glaucoma, HIV/AIDS, or treatment of these conditions; a medical condition or treatment for a medical condition that produces cachexia, severe pain, severe nausea, seizures including those caused by epilepsy, or persistent muscle spasms including those caused by MS; other conditions are subject to approval by the Health Division of the Oregon Department of Human Resources	24 oz usable; 24 plants (6 mature, 18 immature)
Rhode Island, 2006	Cancer, glaucoma, HIV/AIDS, hepatitis C, or treatment of these conditions; a chronic or debilitating disease or medical condition or its treatment that produces cachexia or wasting syndrome, severe debilitating chronic pain, severe nausea, seizures including but not limited to those characteristic of epilepsy, or severe and persistent muscle spasms including but not limited to those characteristic of MS or Crohn disease, agitation of Alzheimer disease, or any other medical condition or its treatment approved by the state department of health	2.5 oz usable; 12 plants
Vermont, 2004	Cancer, HIV/AIDS, MS, or the treatment of these conditions if the disease or the treatment results in severe, persistent, and intractable symptoms; a disease, medical condition, or its treatment that is chronic, debilitating, and produces ≥1 severe, persistent, intractable symptoms of cachexia or wasting syndrome, severe pain or nausea, or seizures	2 oz usable; 9 plants (2 mature, 7 immature)
Washington, 1998	Cachexia, cancer, HIV/AIDS, epilepsy, glaucoma, intractable pain (defined as pain unrelieved by standard treatment or medications), chronic renal failure, MS Crohn disease, hepatitis C with debilitating nausea or intractable pain, or diseases including anorexia that result in nausea, vomiting, wasting, appetite loss, cramping, seizures, muscle spasms, or spasticity when those conditions are unrelieved by standard treatments or medications	24 oz usable; 15 plants

Abbreviations: ALS, amyotrophic lateral sclerosis; HIV, human immunodeficiency virus; IBD, inflammatory bowel disease; MS, multiple sclerosis; PTSD, posttraumatic stress disorder.

[a] For up to date medical marijuana regulations, see http://medicalmarijuana.procon.org/view.resource.php?resourceID=000881.[5]

Aside from the 2 FDA-approved indications for cannabinoids, the scientific evidence supporting the medical use of marijuana and cannabinoids varies widely by disease entity from high-quality evidence to poor-quality evidence. High-quality evidence is defined herein as multiple randomized clinical trials with positive results (Table 3). Despite the variability in evidence supporting various uses for medical marijuana, state policies suggest the use of medical marijuana for many medical problems beyond nausea, vomiting, and anorexia. For some of the medical conditions approved for use in some states (eg, glaucoma), there are only preliminary data supporting the use of medical marijuana as pharmacotherapy.

Data from more than 40 clinical trials of marijuana and cannabinoids have been published; beyond the 2 indications for which dronabinol and nabilone are already approved by the FDA, the strongest evidence exists for the use of marijuana and cannabinoids as pharmacotherapies for chronic pain, neuropathic pain, and spasticity associated with multiple sclerosis. As of March 2015, there were 6 trials (n=325 patients) examining chronic pain, 6 trials (n=396 patients) that investigated neuropathic pain, and 12 trials (n=1600 patients) that focused on multiple sclerosis. Several of these trials had positive results, suggesting that marijuana or cannabinoids may be efficacious for these indications. The American Academy of Neurology (AAN) recently published evidence-based guidelines that recommended an oral cannabis extract containing both THC and cannabidiol (not available in the United States as an FDA-approved medication) as having the highest level of empirical support as a treatment for spasticity and pain associated with multiple sclerosis.[4] The AAN also published a systematic review of medical marijuana as a treatment for neurological disorders, suggesting nabiximols, a spray containing both THC and cannabidiol, as probably effective in treating spasticity, central pain, and urinary dysfunction associated with multiple sclerosis, and dronabinol as probably effective as a treatment for spasticity and central pain associated with multiple sclerosis.[6] Thus, while medical marijuana is not a first-line treatment for Mr Z's chronic pain, it is reasonable to consider medical marijuana as a treatment after other treatments have failed. In general, the evidence supporting the use of marijuana and cannabinoids for other conditions aside from the FDA indications and chronic pain, neuropathic pain, and spasticity resulting from multiple sclerosis is either equivocal or weak.

Marijuana contains numerous cannabinoids. It is not known how individual cannabinoids affect the various diseases currently treated by marijuana. Two of the cannabinoids, dronabinol and nabilone, are available in the United States and can be prescribed. When treating patients for conditions that would otherwise be treated by marijuana itself, it is reasonable to initiate therapy with dronabinol or nabilone. If these are not successful, treatment can be escalated to marijuana itself because it contains numerous pharmacologically active cannabinoids.

Some conditions might respond to cannabinoids not yet available in the United States such as cannabidiol. Under these circumstances, it is reasonable to treat with marijuana itself. A variety of cannabinoids are in development, so new cannabinoids, likely with new FDA indications, should reach the market in the future.

Risks and Benefits of Cannabinoids

Medical marijuana and cannabinoids have health risks and benefits. Mr Z and the physician recommending medical marijuana for him should discuss these risks and benefits thoroughly prior to starting treatment with medical marijuana because many adverse effects may result from either short-term (single-use or sporadic) or long-term use.[45] The acute effects of marijuana include impaired short-

Table 2. Common Cannabis Preparations

Preparations	Description
Marijuana[a]	Dried plant product consisting of leaves, stems, and flowers; typically smoked or vaporized
Hashish	Concentrated resin cake that can be ingested or smoked
Tincture[a]	Cannabinoid liquid extracted from plant; consumed sublingually
Hashish oil	Oil obtained from cannabis plant by solvent extraction; usually smoked or inhaled; butane hash oil (sometimes referred to as "dabs"), for example
Infusion[a]	Plant material mixed with nonvolatile solvents such as butter or cooking oil and ingested

[a] These preparations are available from state-approved medical marijuana dispensaries.

term memory, motor coordination, and judgment. This is especially relevant for driving; short-term use of marijuana doubles the risk of involvement in a motor vehicle crash.[46] Paranoid ideation and psychotic symptoms, albeit rare, may occur in response to high doses of THC. Long-term regular (daily or nearly every day) marijuana use is especially problematic for young people, whose brains continue to develop into their mid-20s.[47] A recent study showed structural brain changes in the nucleus accumbens and the amygdala in occasional marijuana users compared with controls, underscoring the need for additional research into the effects of nonregular marijuana use on the developing brain.[48] Impaired brain development as measured by functional connectivity may contribute to the association between early, regular marijuana use and decline in IQ.[45,49]

Marijuana is potentially addictive, causing significant problems for work, school, and relationships in about 9% of adult and 17% of adolescent users.[50,51] Regular marijuana use is associated with an increased risk of anxiety, depression, and psychotic illness, and marijuana use can worsen the courses of these disorders as well.[52-57] Mr Z has an anxiety disorder for which he takes multiple medications; this anxiety must be monitored closely if medical marijuana pharmacotherapy is used. Functional outcomes are also affected, with regular marijuana use leading to poor school performance, lower income, increased likelihood of requiring socioeconomic assistance, unemployment, criminal behavior, and decreased satisfaction with life.[58-60] The cessation of regular marijuana use is associated with a withdrawal syndrome marked by anxiety, irritability, craving, dysphoria, and insomnia.[61]

Regular marijuana use results in physical problems as well. It is associated with increased incidence of symptoms of chronic bronchitis and increased rates of respiratory tract infections and pneumonia. Preliminary research points to an association between marijuana use and myocardial infarction, stroke, and peripheral vascular disease.[62]

Evaluation of a Patient for Medical Marijuana Certification

Patient requests for medical marijuana are now common in clinical practice. Determining which patients may be appropriate for a medical marijuana certificate (eAppendix in the Supplement) is complicated (Box). Patients administered marijuana should have a condition known to be responsive to marijuana or cannabinoids based on high-quality evidence such as randomized clinical trials. Before receiving marijuana, patients should have undergone adequate trials of other evidence-based treatments. Medical conditions such as major depressive disorder, anxiety disorders, and viral upper respiratory tract infections that may be exacerbated by marijuana should not be present. Patients present to their primary care physicians seeking medical marijuana certification or they may be already using marijuana. Mr Z's case was the latter—he raised the issue with his primary care physician after initiating medical marijuana pharmacotherapy outside of his usual medical care with the assistance of a medical marijuana clinic.

Medical marijuana evaluations should be comprehensive assessments that include risk-benefit discussions. Certifications should only be written by physicians who have thoroughly assessed a patient, know him or her well, and have a full understanding of the patient's debilitating condition requiring treatment. If the certification does not come from the patient's primary care physician or the specialist treating the debilitating condition, it is essential for the certifying physician to communicate with the patient's other health care clinicians in the same manner as any other specialists would be expected to.

The clinical evaluation should start with the patient expressing how they think medical marijuana will be helpful to treat their medical condition. The physician should take a careful history with special focus on previous treatments for the debilitating condition and possible contraindications for medical marijuana such as anxiety disorders, mood disorders, psychotic disorders, and substance use disorders. A thorough risk-benefit discussion should follow, covering both the adverse health effects of marijuana along with the scientific evidence from studies investigating marijuana or cannabinoids as pharmacotherapy for the debilitating condition being treated. It may be useful to provide a context for medical consensus by informing the patient that there currently is little support from major medical organizations for the use of medical marijuana.[63]

If the physician decides to write the certification for medical marijuana, a discussion of marijuana's federal legal status and that state's regulations must follow. According to the US government, marijuana is an illegal drug that is classified as Schedule I under the Controlled Substances Act, meaning that it has no currently accepted medical use and a high potential for abuse.[64] Marijuana's status as a Schedule I substance that is illegal according to the federal government is the reason that physicians cannot prescribe medical marijuana and can only certify its use. Although the US Department of Justice has stated that it plans to leave the issue of medical marijuana to the states and not enforce the federal statute, the federal stance on marijuana still is a cause for concern for some physicians who are considering recommending medical marijuana as a treatment or aligning with medical marijuana dispensaries or treatment centers.

The medical marijuana certification must state the medical condition that the physician believes would be treated effectively with medical marijuana and, in some states, the recommended amount of marijuana needed to treat the condition. For example, a physician in Massachusetts must state the medical condition for

Table 3. Randomized Clinical Trials Beyond Current FDA Indications for Cannabinoids[a]

Source	Drug (Maximum Dose), Route	Control	Sample Size, Experimental Condition/Control	Primary Outcome	Results
Chronic pain					
Skrabek et al,[16] 2008	Nabilone (2 mg) orally	Placebo	n=20 Nabilone; n=20 placebo (fibromyalgia)	VAS	Significant decrease in VAS (−2.04; $P < .02$)
Narang et al,[17] 2008	Dronabinol (20 mg) orally	Placebo	n = 29 Placebo; n = 30 dronabinol, 10 mg; n = 29 dronabinol, 20 mg	Total pain relief at 8 h	Significant increase in Total pain relief, dronabinol conditions (20 mg vs placebo at $P < .01$; 10 mg vs placebo at $P < .05$)
Frank et al,[18] 2008	Dihydrocodeine (240 mg), nabilone (2 mg) orally	Crossover	n=48 Dihydrocodeine followed by nabilone; n=48 nabilone followed by dihydrocodeine (chronic neuropathic pain)	VAS	Dihydrocodeine provided better pain relief than nabilone (6.0; 95% CI, 1.4-10.5; $P=.01$)
Pinsger et al,[19] 2006	Nabilone (1 mg) add-on orally	Placebo	n=30 Crossover	VAS	Significant decrease in VAS ($P < .006$)
Wissel et al,[20] 2006	Nabilone (1 mg) orally	Placebo	n=13 Crossover	11-Point box test (pain rating)	Significant decrease in pain rating ($P < .05$)
Blake et al,[21] 2006	Nabiximols: THC (15 mg)/ cannabidiol (13.5 mg) oromucosal spray	Placebo	n=31 Nabiximols; n=27 placebo	Pain on movement	Significant decrease in pain (−0.95; 95% CI, −1.85 to −0.02, $P=.04$)
Neuropathic pain					
Ellis et al,[22] 2009	Cannabis (1%-8% THC) smoked	Placebo	n=34 Crossover	Change in pain intensity	Significant decrease in pain ($P=.02$)
Abrams et al,[23] 2007	Cannabis (3.56% THC) smoked	Placebo	n=27 Cannabis; n=28 placebo	VAS, percent achieving >30% pain reduction	Significant decrease in pain ($P=.03$); 52% cannabis group vs 24% placebo reported >30% pain reduction ($P=.04$)
Wilsey et al,[24] 2008	Cannabis (7%, THC) smoked	Placebo	n=38 Crossover	VAS	Significant decrease in pain (−0.0035; 95% CI, −0.0063 to −0.0007 ($P=.02$)
Nurmikko et al,[25] 2007	Nabiximols: THC (30 mg)/ cannabidiol (27.5 mg) oromucosal spray	Placebo	n=63 Nabiximols; n=62 placebo	Change in pain intensity (NRS)	Significant decrease in pain ($P=.004$; 95% CI, −1.59 to −0.32)
Berman et al,[26] 2004	Nabiximols: THC (129.6 mg)/ cannabidiol (120 mg) oromucosal spray	Placebo	n=48 Crossover	Mean pain severity	Significant decrease in pain (THC/cannabidiol, −0.58, 95% CI, −0.98 to −0.18, $P=.005$; THC, −0.64, 95% CI, −1.05 to −0.24, $P=.002$)
Multiple sclerosis					
Zajicek et al,[27] 2003, and Freeman et al,[28] 2006	OCE: THC (25 mg), cannabidiol (12.5 mg); THC (25 mg) orally	Placebo	n=211 OCE; n=206 THC; n=213 placebo	Change in spasticity (Ashworth scale)[27]; incontinence episodes[28]	No effect ($P=.40$) on spasticity; decrease in episodes for both OCE and THC ($P=.005$ OCE; $P=.04$ THC)
Zajicek et al,[29] 2012	OCE (THC, 25 mg) orally	Placebo	n=144 OCE; n=135 placebo	Change in muscle stiffness	Significant decrease in muscle stiffness (odds ratio, 2.26; 95% CI, 1.24-4.13; $P=.004$)
Aragona et al,[30] 2009	Nabiximols: THC (27 mg)/ cannabidiol (25 mg) oromucosal spray	Placebo	n=17 Crossover	Psychopathology, cognition (Paced Auditory Serial Addition Test, Symptom Checklist 90-Revised)	No effect (Symptom Checklist 90-Revised, $P=.36$-$.91$; Paced Auditory Serial Addition Test, $P=.39$)
Collin et al,[31] 2007	Nabiximols: THC (129 mg)/ cannabidiol (120 mg) oromucosal spray	Placebo	n=124 nabiximols; n=65 placebo	Change in spasticity (NRS)	Significant decrease in spasticity (−0.52, 95% CI, −1.029 to −0.004, $P=.048$)
Kavia et al,[32] 2010	Nabiximols: THC (129 mg)/ cannabidiol (120 mg) oromucosal spray	Placebo	n=67 Nabiximols; n=68 placebo (overactive bladder)	Incontinence episodes	No difference ($P=.57$)
Vaney et al,[33] 2004	OCE: THC (30 mg) orally	Placebo	n=57 Crossover	Change in spasticity (self-report, frequency of symptoms)	No difference (frequency, $P=.01$; 95% CI, 1.76-4.63)
Ungerleider et al,[34] 1987	THC (7.5 mg) orally	Placebo	n=13 Crossover	Change in spasticity (self-report)	Significant decrease in spasticity ($P < .03$)
Svendsen et al,[35] 2004	Dronabinol (10 mg) orally	Placebo	n=24 Crossover (central pain)	Median spontaneous pain intensity (NRS) in last week of treatment	Significant decrease in median spontaneous pain intensity ($P=.02$)
Rog et al,[36] 2005	Nabiximols: THC (129.6 mg)/ cannabidiol (120 mg) oromucosal spray	Placebo	n=34 Nabiximols; n=32 placebo (central pain)	Pain, sleep disturbance (NRS)	Significant decrease in pain ($P=.005$), significant decrease in sleep disturbance ($P=.003$)
Fox et al,[37] 2004	OCE: THC (10 mg) orally	Placebo	n=14 Crossover (upper limb tremors)	Change in tremor index	No significant improvements ($P=.55$)

(continued)

Table 3. Randomized Clinical Trials Beyond Current FDA Indications for Cannabinoids[a] (continued)

Source	Drug (Maximum Dose), Route	Control	Sample Size, Experimental Condition/Control	Primary Outcome	Results
Wade et al,[38] 2004	Nabiximols: THC (129.6 mg)/cannabidiol (120 mg) oromucosal spray	Placebo	n=80 Nabiximols; n=80 placebo	VAS, most troublesome symptom	No significant improvements (*P*=.12); significant decrease in spasticity (−22.79; 95% CI, −35.52 to −10.07; *P*=.001)
Killestein et al,[39] 2002	Dronabinol (5 mg); OCE: THC (5 mg) orally	Placebo	n=16 Crossover (spasticity)	Change in spasticity (Ashworth scale)	No significant improvements
Parkinson disease					
Carroll et al,[40] 2004	OCE: THC (10 mg) orally	Placebo	n=19 Crossover (levodopa-induced dyskinesia)	Change in Unified Parkinson Disease Rating Scale dyskinesia score	No significant improvements (*P*=.09)
Crohn disease					
Naftali et al,[41] 2013	Cannabis: THC (115 mg) smoked	Placebo	n=11 Cannabis; n=10 placebo	Induction of remission (Crohn's Disease Activity Index score <150 after 8 wk)	No significant difference (*P*=.43)
Amyotrophic lateral sclerosis					
Weber et al,[42] 2010	Sesame oil: THC (10 mg) orally	Placebo	n=27 Crossover (cramps)	VAS, cramp intensity	No significant difference (0.24; 95% CI, −0.32 to 0.81; *P*=.38)
Neurogenic symptoms					
Wade et al,[43] 2003	Nabiximols: THC (120 mg)/cannabidiol (120 mg); THC (120 mg); cannabidiol (120 mg) oromucosal spray	Placebo	n=24 Crossover (n=18 multiple sclerosis, n=4 spinal cord injury, n=1 brachial plexus damage, n=1 limb amputation due to neurofibromatosis)	VAS	Significant decrease in pain with cannabidiol, THC; significant decrease in spasm with THC, cannabidiol, THC; significant decrease in spasticity with THC (*P* < .05)

Abbreviations: NRS, numerical rating scale; OCE, oral cannabis extract; THC, δ-9-tetrahydrocannabinol; VAS, visual analog scale.

[a] Randomized clinical trials are graded as level 2 evidence (level 1 includes systematic reviews of randomized clinical trials) according to the Oxford Centre for Evidence-Based Medicine 2011 levels of evidence.[44]

Box. Practical Considerations for Medical Marijuana

An appropriate medical marijuana candidate should have

1. A debilitating medical condition that data from randomized clinical trials suggest would respond to medical marijuana pharmacotherapy, such as nausea and vomiting associated with cancer chemotherapy, anorexia from wasting illnesses like AIDS, chronic pain, neuropathic pain, or spasticity associated with multiple sclerosis
2. Multiple failed trials of first- and second-line pharmacotherapies for these conditions
3. A failed trial of an US Food and Drug Administration–approved cannabinoid (dronabinol or nabilone)
4. No active substance use disorder or psychotic disorder or no unstable mood disorder or anxiety disorder
5. Residence in a state with medical marijuana laws and meets requirements of these laws

which medical marijuana is the treatment and a recommended amount per 60-day period. The amount should be estimated from the route of administration and the anticipated number of treatments per day. Patients receive advice on which marijuana species or strain to purchase and dosing and administration from the dispensary, which differs from the manner in which prescriptions of FDA-approved medications are specified. Once the patient begins medical marijuana pharmacotherapy, close follow-up with the physician is imperative, as it would be with any medications having significant adverse effects and abuse potential. The patient should be seen in follow-up within a month's time with additional telephone contact as necessary. Patients may be followed up monthly for 3 months, with further follow-up determined by the patient's clinical situation.

Patients requesting medical marijuana may already be taking opioids for chronic pain. In these instances, narcotics contracts may be in effect as an additional safeguard to mitigate the potential for abuse. Physicians recommending medical marijuana to these patients can use the narcotics contract to their advantage because in addition to the patient specifying where her or she will fill narcotics prescriptions, the patient can be asked to specify where he or she will obtain marijuana. The contract may also stipulate that random urine drug screening results positive for substances other than the prescribed opioids and recommended medical marijuana may be grounds for discharge.

Recommendations for Mr Z

Mr Z has had extensive treatment for his chronic pain over an extended period. He was referred to a variety of health care practitioners from multiple disciplines for his chronic pain. His clinicians used multiple modalities including multiple medications resulting in limited pain control before Mr Z considered medical marijuana as a treatment for his chronic pain. Overall, it appears that his treatment course was reasonable and likely a result of thoughtful collaboration between Mr Z and his primary care physician.

Mr Z appears to meet all but 1 of the criteria listed in the Box: he has a debilitating condition that data suggest may respond to marijuana, he has had multiple failed treatment trials of first- and second-line medications, his anxiety disorder appears to be clinically stable, and he resides in Massachusetts, a state with an active medical marijuana law. Only a previous trial of an FDA-approved synthetic cannabinoid was not done.

The course of treatment may have been altered if Mr Z had a discussion with his primary care physician prior to obtaining a medical marijuana certification. Mr Z and his primary care physician may have opted for a trial of one of the FDA-approved cannabinoids dronabinol or nabilone, despite Mr Z's medical history of anxiety. This anxiety, which appears to be clinically stable now, should have been monitored closely and medications adjusted accordingly. A trial of dronabinol still makes sense at this time because it would allow for the use of an FDA-approved (and thus likely safer in terms of composition and quality control) medication under the close supervision of Mr Z's primary care physician. He went to a specialty medical marijuana clinic, however, and 4 to 6 weeks elapsed without follow-up prior to Mr Z notifying his primary care physician that he was taking a medication with potentially significant adverse effects. This lack of follow-up is one of the major concerns about specialty medical marijuana clinics that often certify large numbers of new patients for medical marijuana each day. Regardless of where patients receives certification, they must be followed up closely by the certifying physician because of the potential for significant adverse effects, and the certifying physician should communicate with all other health care professionals delivering care that may be affected by a patient's use of medical marijuana.

Initiation of medical marijuana pharmacotherapy by patients before consulting their physician is becoming more common as additional states enact medical marijuana laws. These patients, along with others contemplating medical marijuana pharmacotherapy for their own medical problems, will likely continue to comprise a growing proportion of physicians' patients. Although the medical marijuana landscape will change as novel cannabinoids are approved for additional medical indications, the question of the role of medical marijuana as a pharmacotherapy in medicine persists. Physicians must educate patients about proper use of medical marijuana to ensure that only appropriate patients use it and limit the numbers of patients inappropriately using this treatment.

Questions and Discussion

QUESTION One of my patients said that he found one strain that worked better than others for chronic pain. Do different strains of marijuana that are available at the dispensaries have different effects?

DR HILL Different strains may have different effects because of their THC and cannabidiol content and differing ratios of THC to cannabidiol in the strain.[65] Just as different people may respond differently to the same drug, some may report better results from a particular strain than other people might. Medical marijuana dispensaries may make claims about certain strains being useful for particular illnesses, but those claims are theoretical or anecdotal in nature and may be made with marketing in mind.

QUESTION As it stands right now in Massachusetts, can any physician write a medical marijuana certification? What if a physician wants to write a certification for a patient to use medical marijuana for a medical condition that is not specified by the laws?

DR HILL Yes, in Massachusetts and in every other state with medical marijuana laws, any physician can write a medical marijuana certification for any medical indication they choose, provided the physician has completed the requisite training.[66] This training usually consists of a few hours of continuing medical education activities related to the risks and benefits of marijuana.

QUESTION In Massachusetts, the state allows the certifying physician to stipulate how much medical marijuana a patient may possess in a 60-day period, and the recommended 60-day supply of marijuana is 10 oz. Is that an unnecessarily high amount? How does one determine the correct dose of marijuana to use?

DR HILL The 60-day supply of 10 oz is a recommended amount, but this may be exceeded if a physician provides a rationale for it in writing. According to the World Health Organization, a standard marijuana cigarette contains as little as 0.5 g of marijuana, so a 60-day supply of 10 oz is up to 560 marijuana cigarettes or almost 10 per day.[67] Thus, based on the estimate of 0.5 g per marijuana cigarette, a patient requiring the marijuana equivalent of 1 to 2 marijuana cigarettes per day would need 0.5 to 1 oz of marijuana per month. Although no one wants to keep a medication away from someone who might benefit from it, this 60-day supply estimate appears to be another example in which marijuana policy is ahead of the science. Circumstances in which people need 10 oz per 60 days to make tinctures or other forms of marijuana-based medicines should be rare. There are little data available for optimal dosing of marijuana for particular medical conditions.[68] Dosing differs based on the route of administration, which determines the pharmacology of the various cannabinoids in marijuana as well as the processes of absorption and metabolism.[69] Dosing is determined for an individual patient using a titration process. The marijuana dose is increased until the desired clinical effect—pain relief in Mr Z's case—is achieved. The necessary dose is highly dependent on the THC concentration of the marijuana being used. If using a vaporizer to heat the plant material into a vapor for inhalation, a patient should start with a single inhalation of marijuana vapor and monitor for effect. If 20 minutes pass with no effect, the patient may take 2 inhalations consecutively, then monitor for another 20 minutes. Inhalations are spaced out because numerous consecutive inhalations may result in missing the window of optimal treatment effect. This titration process must be repeated if a different strain of marijuana is used.

QUESTION What is the state of insurance coverage on some of these FDA-approved cannabinoid medications and medical marijuana?

DR HILL No insurance companies cover medical marijuana, and there has not been any movement toward increased coverage by insurance companies. The cannabinoids dronabinol and nabilone are expensive medications that are covered by insurance companies for their FDA indications as well as for other indications on a case-by-case basis.

Conclusions

Medical marijuana use is now common in clinical practice, and it is critical for physicians to understand both the scientific rationale and the practical implications of medical marijuana laws. Medical marijuana and cannabinoids have significant health risks as well as many potential medical benefits. While medical marijuana has been at times a controversial and contentious issue, physicians have a responsibility to provide evidence-based guidance on this important issue.

- With more states enacting medical marijuana laws, it is imperative for physicians to understand both the scientific rationale and the practical implications of medical marijuana laws.
- Aside from nausea and appetite stimulation, indications for which there are 2 FDA-approved cannabinoids (dronabinol and nabilone), chronic pain, neuropathic pain, and spasticity associated with multiple sclerosis are the indications for medical marijuana supported by high-quality evidence.
- Medical marijuana and cannabinoids have significant potential health risks, such as addiction and worsening of psychiatric illnesses such as some anxiety disorders, mood disorders, psychotic disorders, and substance use disorders, as well as many potential medical benefits.
- Evaluations to determine the appropriateness of medical marijuana for a patient should be comprehensive assessments that revolve around risk-benefit discussions.

ARTICLE INFORMATION

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Medical Marijuana for Treatment of Chronic Pain and Other Medical and Psychiatric Problems: A Clinical Review.

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Author information

Erratum in

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Abstract

IMPORTANCE: As of March 2015, 23 states and the District of Columbia had medical marijuana laws in place. Physicians should know both the scientific rationale and the practical implications for medical marijuana laws.

OBJECTIVE: To review the pharmacology, indications, and laws related to medical marijuana use.

EVIDENCE REVIEW: The medical literature on medical marijuana was reviewed from 1948 to March 2015 via MEDLINE with an emphasis on 28 randomized clinical trials of cannabinoids as pharmacotherapy for indications other than those for which there are 2 US Food and Drug Administration-approved cannabinoids (dronabinol and nabilone), which include nausea and vomiting associated with chemotherapy and appetite stimulation in wasting illnesses.

FINDINGS: Use of marijuana for chronic pain, neuropathic pain, and spasticity due to multiple sclerosis is supported by high-quality evidence. Six trials that included 325 patients examined chronic pain, 6 trials that included 396 patients investigated neuropathic pain, and 12 trials that included 1600 patients focused on multiple sclerosis. Several of these trials had positive results, suggesting that marijuana or cannabinoids may be efficacious for these indications.

CONCLUSIONS AND RELEVANCE: Medical marijuana is used to treat a host of indications, a few of which have evidence to support treatment with marijuana and many that do not. Physicians should educate patients about medical marijuana to ensure that it is used appropriately and that patients will benefit from its use.

Summary for patients in

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To whom it may concern,

On request of [redacted], as his advocate and nurse for the past eight years; I have observed and assisted [redacted] through extensive pain episodes, often lasting for several days at a time. Pain that often prevents him from sitting up, drinking liquids, and ultimately preventing quality of life whatsoever. General nursing practices have little to no effect on his pain. NSAIDS and opiods have side effects which are contradictory to his condition.

Modern day medical practices provide assistance to prolong life but do little to provide answers to consequences of extending that life. [redacted] is twenty years past his life expectancy. At present, the pain medication provided is not adequate, effective or appropriate for [redacted]. He is requesting adding his diagnosis to the list for Medical Marijuana, so he would be eligible to receive the drops when they are needed.

Thank you,
[redacted] L.P.N.