What is HBOT?
Who Benefits?
What Can It Do for Your Patients?
HBOT Hot Topics

Jodi Boory BSN RN CRRN ACHRN CWCA OMS
Manager of Wound Care
UPMC Passavant

No disclosures

No manufacture had input into this presentation.

What is hyperbaric oxygen therapy?

HYPERBARIC OXYGEN THERAPY (HBOT) is a modality in which the ***entire body is exposed to oxygen under increased atmospheric pressure***. The patient is entirely enclosed in a pressure chamber breathing 100% oxygen (O_2) at greater than one atmosphere pressure. Either a mono-place chamber pressurized with pure O_2 or a larger multi-place chamber pressurized with compressed air where the patient receives pure O_2 by mask, head tent, or endotracheal tube may be used.


HEAD END

Effects of HBOT

- Hyperoxygenation
- Direct pressure
- Enhanced antimicrobial activity

Neovascularization and angiogenesis

Vasoconstriction

Reversal of reperfusion injuries

Hyperbaric oxygen requires several daily treatments.

The effects of hyperbaric oxygen on the blood vessel growth and tissue healing is very gradual.

HBO is an adjunctively treatment.

It is most effective when combined with surrounding surgery, antibiotics, wound care, debridement and offloading.

Reimbursed diagnosis and required documentation to keep the reimbursement received:

Osteoradionecrosis (ORN)

- Coverage is limited to cases with evidence of bony resorption or overt fracture
- Radiation treatment to the affected area has ended at least 6 months prior to the onset of signs or symptoms and /or planned surgical intervention at the site (delayed injury)
- Medicare and other payer will no longer cover HBO for the prevention of ORN in previously irradiated mandible undergoing tooth extractions.

** Now covered by UPMC**

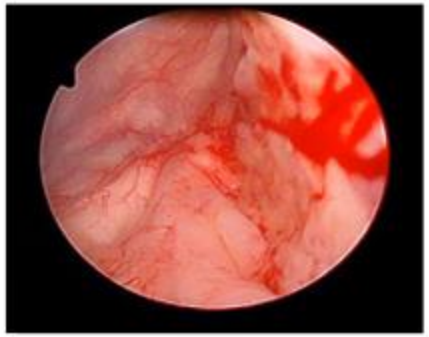
Soft Tissue Radionecrosis (STRN)

Evidence of soft tissue damage present- disabling, progressive, painful tissue breakdown, bleeding, bowel or bladder dysfunction, wound dehiscence, infection, tissue loss, and graft or flap loss.

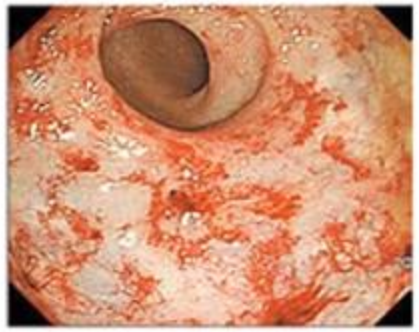
Radiation treatment to the affected area has ended at least 6 months prior to the onset of signs or symptoms and / or planned surgical intervention at the (delayed injury).

Chronic Radiation Cystitis & Proctitis

Neovascularity associated w/ irradiation cystitis. When distended, these weak-walled vessels often rupture, resulting in submucosal hemorrhage & gross hematuria



Chronic radiation proctitis symptoms may include ulcerations, severe bleeding, strictures, perforation, fistula and bowel obstruction.

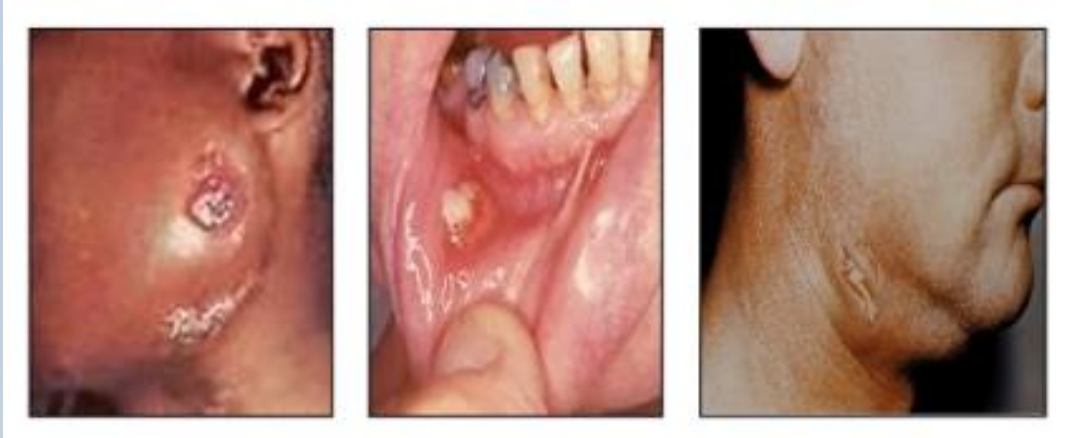


Chronic Radiation Cystitis & Proctitis

Radiation therapy is an integral tool in the treatment for tumors of the pelvic organs.

Unfortunately, late radiation injury to the bladder, prostate, pelvis, etc. can develop months to years after radiation treatment and become chronic/ refractory to traditional treatment methods.

Actinomycosis



Chronic Refractory Osteomyelitis

- Prolonged use of antibiotics > 4 weeks
- Surgical debridement with removal of as much infected bone matrix as possible which was acting as a foreign body.
- Recent bone scan, bone biopsy, MRI or bone culture of affected area that documents presence of osteomyelitis greater than 30 days.

Preservation of Skin/Flaps

- Evidence of hypoxia
- Decreased perfusion that has compromised viability
- Skin flap only
- Must have OR note with documentation of skin flap
- Acute problem
- Must start within 72 hours of noted compromise viability
- Surgical procedure must have been with 72 hours
- Treatment dives not to exceed 20

Diabetic wounds of the lower extremities

- Type I or II Diabetes
- Lower extremity wound that is the result of diabetes
- Wagner Grade III or greater for over 30 days
- No measurable healing utilizing standard of care for 30 days
- Documentation of treatment for 30 days within standard of care
- Vascular evaluation
- ABI not less than 0.6
- Correction of vascular problems in affected limb
- Optimization of nutritional status
- Optimization of glucose control
- Debridement of devitalized tissue
- Maintenance of a clean, moist bed of granulation tissue with appropriate moist dressings
- Appropriate off-loading
- Treatment of infection

GAS EMBOLISM
Arterial (AGE) and Venous (VGE)

- Early recompression therapy reduces bubble volume and drives gas into physical solution, while high oxygen pressure washes our inert gas from bubbles.
- High PO_2 creates a large diffusion gradient for inert gas to leave bubble.
- With restored blood flow poorly oxygenated tissues receive more oxygen, and local swelling subsides.

GAS EMBOLISM
Arterial (AGE) and Venous (VGE)

Treatment

- CPR
- Supplemental oxygen (increase gradient)
- Volume expansion
- Physically remove gas if possible
- HBO not first line therapy

Decompression Sickness

Results from a sudden reduction in ambient pressure resulting in the formation of inert gas bubbles in blood or body tissues or the rate of reduction of ambient pressure exceeds the rate of washout of the inert gas from tissues.

DCS DOES OCCUR IN DIVERS WELL WITHIN NO “D” LIMITS OR WHO HAVE CAREFULLY FOLLOWED DECOMPRESSION TABLES

CARBON MONOXIDE POISONING & CO/CYANIDE POISONING

- Can only be removed from hemoglobin through degradation
- **The standard half-life is 320 minutes on room air**
- The half-life is reduced to 80 minutes with administration of 100% oxygen
- The half-life is reduced to 23 minutes with administration of hyperbaric oxygen at 3 ATA
- Pregnant and a COHb of 15 % or more – treat the fetus.

COMPARTMENT SYNDROME / CRUSH INJURY & OTHER REPERFUSION INJURIES

Signs and Symptoms:

- Pain
- Pallor
- Absent distal pulses
- No capillary blush (reddening of nail bed after pinching blood out temporarily)
- Edema and thickening can be followed by electrolyte disturbance

Central Retinal Artery Occlusion

- Ophthalmic emergency
- The retina has the highest rate of oxygen consumption of any organ in the body at 13ml/100g/min
- Treatment of choice is HBO as minimally invasive procedures have proven to not provide any significant benefit
- Anterior chamber paracentesis
- Decrease intraocular pressure, increase retinal perfusion
- IV acetazolamide
- Decrease intraocular pressure
- Induce vasodilatation
- Direct thrombolytic infusion

Central Retinal Artery Occlusion

Symptoms:
- Sudden changes or loss of vision
- Clouds, changing shapes or shadows in the vision
- HBO is the only treatment

Not on LCD- limited coverage

Idiopathic Sudden Sensorineural Hearing Loss

- Defined as hearing loss of 30 dB within 3 days over at least 3 contiguous frequencies.
- Usually presents as unilateral hearing loss, vertigo, tinnitus and a sensation of aural fullness.
- Incidence 5-20 cases per 100,000.
- Estimated that 65% will resolve spontaneously.

Idiopathic Sudden Sensorineural Hearing Loss

Idiopathic sudden sensorineural hearing loss (SSHL) - SSHL greater than 30 dB affecting greater than 3 consecutive frequencies of pure-tone thresholds when member has failed oral and intra-tympanic steroids, and HBOT is initiated within 3 months after onset (up to 20 sessions);
H91.20 - H91.23

Not usually covered

NECROTIZING SOFT TISSUE INFECTIONS

Many bodily defenses are oxygen-dependent.
Oxygen is:

- Bactericidal (bacteria killing)
- Bacteriostatic (bacteria stopping)

HBOT:

- Increases the rate at which leukocytes produce toxic radicals for microbial killing.
- Enhances aminoglycoside function

Antibiotics that are effective against aerobic gram-negative bacilli and mycobacterium tuberculosis

Streptomycin, neomycin, gentamycin

NECROTIZING SOFT TISSUE INFECTIONS

Antibiotics that are effective against aerobic gram-negative bacilli and mycobacterium tuberculosis:

Streptomycin, neomycin, gentamycin

Hyperbaric oxygen enhances aminoglycoside's function.

Aminoglycosides are antibiotics effective against aerobic gram-negative bacilli and Mycobacterium tuberculosis.

Common aminoglycosides are streptomycin, neomycin and gentamycin.

Hyperbaric oxygen is bacteriostatic and bactericidal in selected mixed soft tissue infections.

https://localcoverage.cms.gov/mcd_archive/view/lcd.aspx?lcdInfo=35021:163

Contents

RETIRED | Local Coverage Determination (LCD)

Hyperbaric Oxygen (HBO) Therapy

L35021

RETIRED

Contractor Information

LCD Information

Document Information

LCD ID
L35021

LCD Title
Hyperbaric Oxygen (HBO) Therapy

Source Proposed LCD
DL35021 Hyperbaric Oxygen (HBO) Therapy

Original Effective Date
For services performed on or after 10/01/2015

Revision Effective Date

9. HBO's use in the treatment of Osteoradionecrosis and Soft Tissue Radiation Injury (Radionecrosis) is one part of an overall plan of care that also includes debridement or resection of nonviable tissue in conjunction with antibiotic therapy. A consistent cause and effect of radiation injury is vascular obliteration and stromal fibrosis or scarring; subsequently the known impact of hyperbaric oxygen therapy, stimulation of angiogenesis, is an important mechanism of recovery. A reduction in fibrosis of soft tissue as well as mobilization and increase of stem cells within radiated tissue has been documented predominantly in animal studies; however, the impact of HBOT is likely to involve all these mechanisms.

   HBO treatment can be indicated in the preoperative and postoperative management of existing osteoradionecrosis or soft tissue radionecrosis, but must be utilized as an adjunct to conventional therapy. Beneficiaries suffering from soft tissue damage or bone necrosis present with disabling, progressive, painful tissue breakdown, bleeding, bowel or bladder dysfunction, wound dehiscence, infection, tissue loss and graft or flap loss.

   Prerequisite for treatment includes history of radiation treatment to the region of the documented injury, terminating at least 6 months prior to onset of signs or symptoms or planned surgical intervention at the site. Numerous forms of soft tissue radiation necrosis and treatment with HBOT have been documented with beneficial effect. Tissues previously irradiated with subsequent planned surgery appear to benefit from HBOT surrounding the surgery with decreased morbidity from large vessel necrosis. For this reason patients manifesting signs and symptoms of radiation injury will be approved for coincidental HBOT, without the histologic diagnosis of ongoing osteoradionecrosis or soft tissue radionecrosis.

   The goal of HBO treatment is to increase the oxygen tension in both hypoxic bone and tissue to stimulate growth in functioning capillaries, fibroblastic proliferation and collagen synthesis.

   The recommended daily treatments are designed around the stages of radionecrosis and typically last 90-120 minutes at 2.0 to 2.5 ATA. The duration of HBO therapy for these patients is highly individualized but is not expected to exceed 4-8 weeks therapy. The Marx mandibular osteoradionecrosis protocol extends from 30-60 treatments based on stage I-III, adhering to the established principle that all necrotic bone must be debrided. Soft tissue radionecrosis usually responds with 30-40 treatments, followed by reconstruction if deemed necessary. An additional 10 treatments is usual following the reconstruction for support of the underlying and surrounding tissue. All treatment is individualized and should be assessed for benefit and outcome each 30 days.

   No demonstrable evidence of improvement post two 30 day periods of HBOT (2.0-2.5 ATA, for 90 to 120 minutes, 5 days per week) suggests lack of benefit and subsequent treatments will be denied as not medically reasonable and necessary. No benefit has been demonstrated for treatment of acute radiation injury or burn, usually manifest coincident with radiation therapy or within the ensuing 6 months of the therapy. Documentation of mitigating factors contributing to injury coincident to the radiation or other factors may allow reimbursement for treatment not traditionally meeting criteria for radionecrosis.

Associated Documents

Attachments

There are no attachments for this LCD.

Related Local Coverage Documents

Articles

A56714 - Billing and Coding: Hyperbaric Oxygen (HBO) Therapy

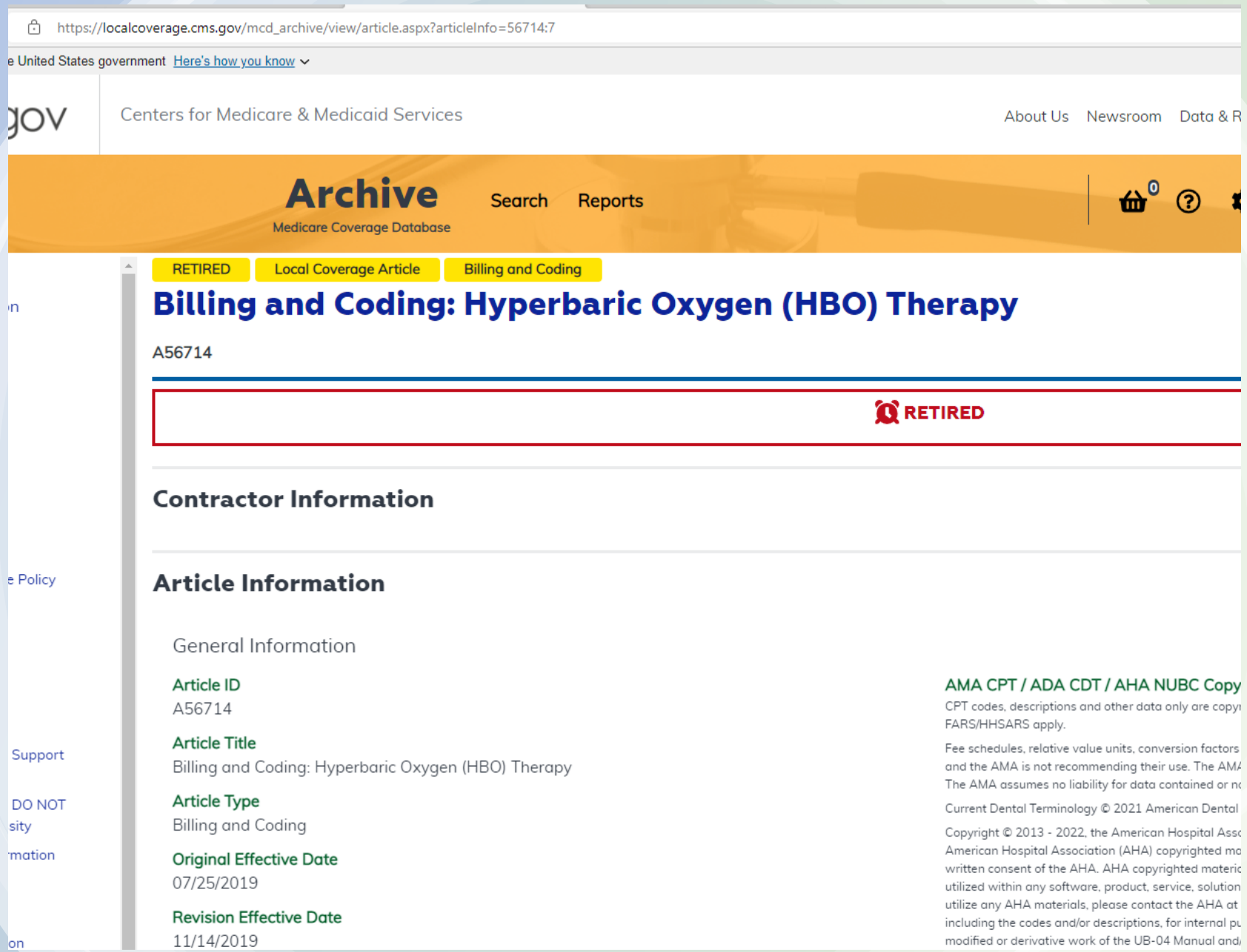
Related National Coverage Documents

NCDs

20.29 - Hyperbaric Oxygen Therapy (MCD)

Public Versions

Updated On	Effective Dates


https://localcoverage.cms.gov/mcd_archive/view/article.aspx?articleInfo=56714:7
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gov
Centers for Medicare & Medicaid Services
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Medicare Coverage Database
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RETIRED
Local Coverage Article
Billing and Coding
Billing and Coding: Hyperbaric Oxygen (HBO) Therapy
A56714
RETIRED
Contractor Information
Article Information
General Information
Article ID
A56714
Article Title
Billing and Coding: Hyperbaric Oxygen (HBO) Therapy
Article Type
Billing and Coding
Original Effective Date
07/25/2019
Revision Effective Date
11/14/2019
AMA CPT / ADA CDT / AHA NUBC Copy
CPT codes, descriptions and other data only are copy
FARS/HHSARS apply.
Fee schedules, relative value units, conversion factors
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including the codes and/or descriptions, for internal pu
modified or derivative work of the UB-04 Manual and/

ICD-10-CM Codes that Support Medical Necessity

Expand All | Collapse All

Group 1 (1 Code)

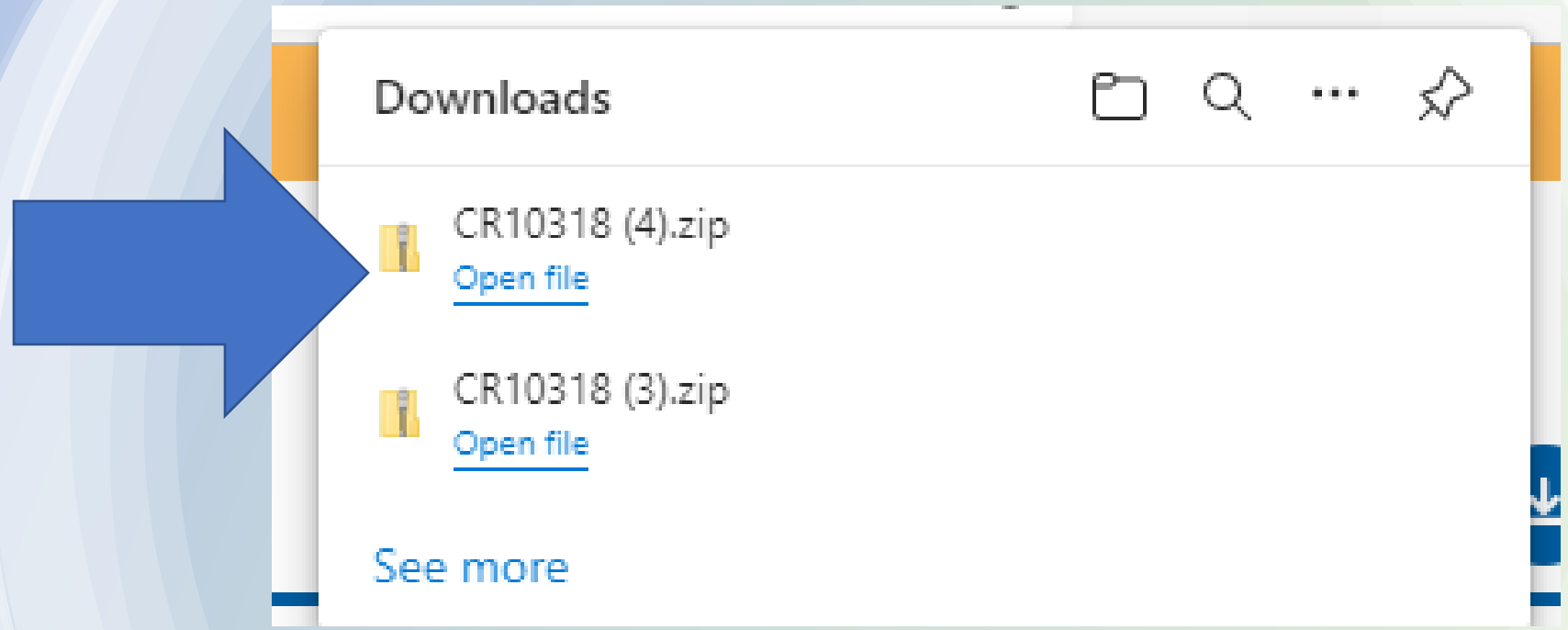
Group 1 Paragraph

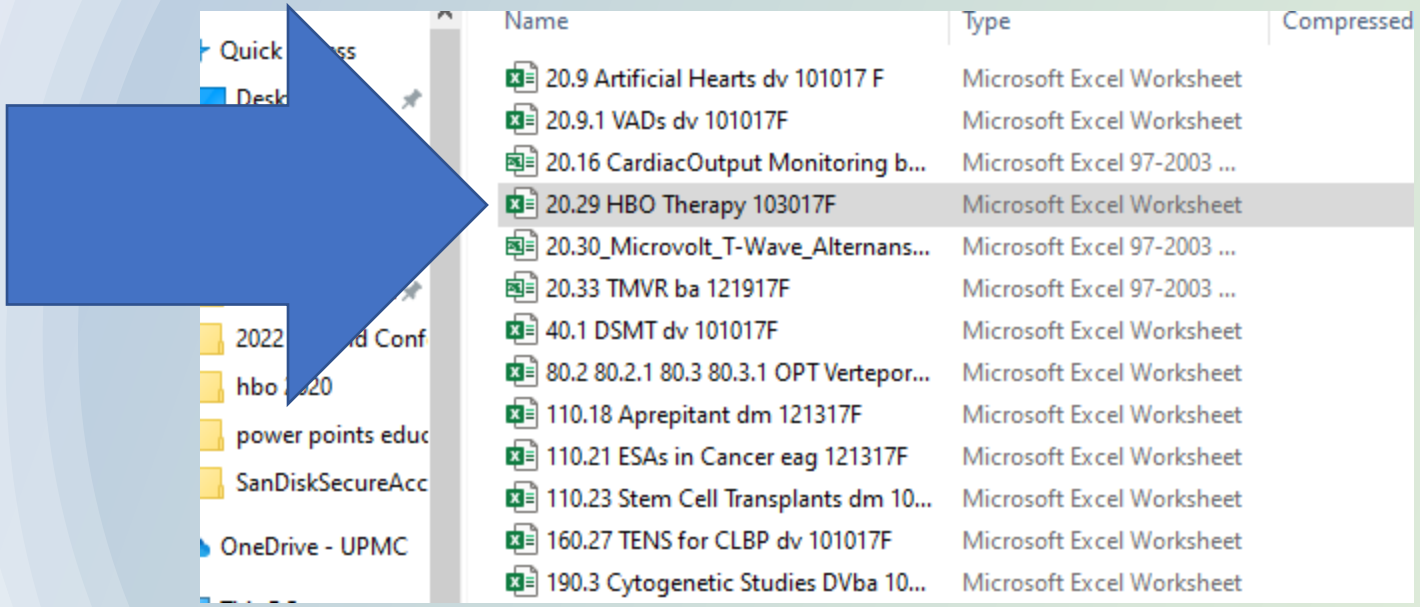
It is the provider's responsibility to select codes carried out to the highest level of specificity and selected from the code book appropriate to the year in which the service is rendered for the claim(s) submitted.

Covered ICD-10 diagnoses codes may be downloaded at https://www.cms.gov/Medicare/Coverage/DeterminationProcess/downloads/CR10318.zip, choose the spreadsheet 20.29 HBO Therapy 103017F.

Group 1 Codes

Code	Description
XX000	Not Applicable


Downloads
CR10318 (4).zip
Open file
CR10318 (3).zip
Open file
See more


Quick
Desk
2022
d Conf
hbo
power points educ
SanDiskSecureAcc
OneDrive - UPMC
Name
Type
Compressed
20.9 Artificial Hearts dv 101017 F
Microsoft Excel Worksheet
20.9.1 VADs dv 101017F
Microsoft Excel Worksheet
20.16 CardiacOutput Monitoring b...
Microsoft Excel 97-2003 ...
20.29 HBO Therapy 103017F
Microsoft Excel Worksheet
20.30_Microvolt_T-Wave_Alternans...
Microsoft Excel 97-2003 ...
20.33 TMVR ba 121917F
Microsoft Excel 97-2003 ...
40.1 DSMT dv 101017F
Microsoft Excel Worksheet
80.2 80.2.1 80.3 80.3.1 OPT Vertepor...
Microsoft Excel Worksheet
110.18 Aprepitant dm 121317F
Microsoft Excel Worksheet
110.21 ESAs in Cancer eag 121317F
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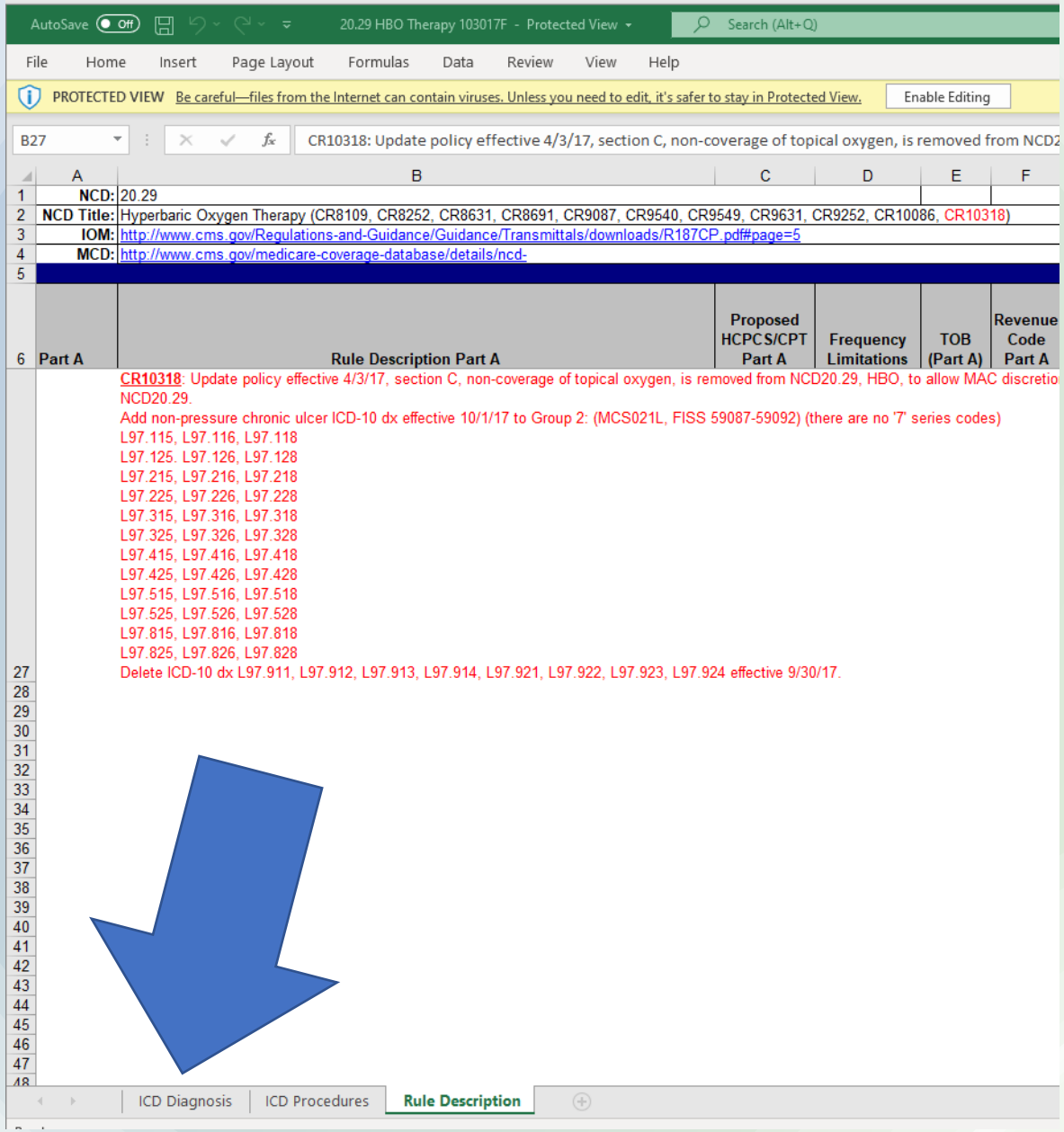
110.23 Stem Cell Transplants dm 10...
Microsoft Excel Worksheet
160.27 TENS for CLBP dv 101017F
Microsoft Excel Worksheet
190.3 Cytogenetic Studies DVba 10...
Microsoft Excel Worksheet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Search (Alt+Q)
File Home Insert Page Layout Formulas Data Review View Help
PROTECTED VIEW Be careful—files from the Internet can contain viruses. Unless you need to edit, it's safer to stay in Protected View.
Enable Editing
B27
CR10318: Update policy effective 4/3/17, section C, non-coverage of topical oxygen, is removed from NCD2
NCD: 20.29
NCD Title: Hyperbaric Oxygen Therapy (CR8109, CR8252, CR8631, CR8691, CR9087, CR9540, CR9549, CR9631, CR9252, CR10086, CR10318)
IOM: http://www.cms.gov/Regulations-and-Guidance/Guidance/Transmittals/downloads/R187CP.pdf#page=5
MCD: http://www.cms.gov/medicare-coverage-database/details/ncd-
Part A
Rule Description Part A
Proposed HCPCS/CPT Part A
Frequency Limitations
TOB (Part A)
Revenue Code Part A
CR10318: Update policy effective 4/3/17, section C, non-coverage of topical oxygen, is removed from NCD20.29, HBO, to allow MAC discretio
NCD20.29.
Add non-pressure chronic ulcer ICD-10 dx effective 10/1/17 to Group 2: (MCS021L, FISS 59087-59092) (there are no '7' series codes)
L97.115, L97.116, L97.118
L97.125. L97.126, L97.128
L97.215, L97.216, L97.218
L97.225, L97.226, L97.228
L97.315, L97.316, L97.318
L97.325, L97.326, L97.328
L97.415, L97.416, L97.418
L97.425, L97.426, L97.428
L97.515, L97.516, L97.518
L97.525, L97.526, L97.528
L97.815, L97.816, L97.818
L97.825, L97.826, L97.828
Delete ICD-10 dx L97.911, L97.912, L97.913, L97.914, L97.921, L97.922, L97.923, L97.924 effective 9/30/17.
ICD Diagnosis
ICD Procedures
Rule Description

AutoSave Off | 20.29 HBO Therapy 103017F - Protected View | Search (Alt+Q)

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C404

	A	B	C	D
1	NCD:	20.29		
2	NCD Title:	Hyperbaric Oxygen Therapy		
3	IOM:	http://www.cms.gov/Regulations-and-		
4	MCD:	http://www.cms.gov/medicare-coverage-database/details/ncd-details.aspx?NCDId=12&ncdver=3&NCAId=37&NcaName=Hyperbaric+Oxygen+Therapy+for+Hypoxic+Wounds+and+Diabetic+Wounds+of+the+Lower+Extremities&IsPopup=y&bc=AAAAAAAAIAAA&		
5			ICD-10 CM	ICD-10 DX Description
6		CMS reserves the right to add or remove codes associated with its NCDs in order to implement those NCDs in the most efficient manner within the confines of the policy.		
7		Single Diagnosis Codes - One code from this list will satisfy medical necessity (see Group lists below for dual diagnosis code requirments)		
8			A42.0	Pulmonary actinomycosis
9			A42.1	Abdominal actinomycosis
10			A42.2	Cervicofacial actinomycosis
11			A42.89	Other forms of actinomycosis
12			A42.9	Actinomycosis, unspecified
13			A43.0	Pulmonary nocardiosis
14			A43.1	Cutaneous nocardiosis
15			A43.8	Other forms of nocardiosis
16			A43.9	Nocardiosis, unspecified
17			A48.0	Gas gangrene
18			B47.1	Actinomycetoma
19			B47.9	Mycetoma, unspecified
20			I74.2	Embolism and thrombosis of arteries of the upper extremities
21			I74.3	Embolism and thrombosis of arteries of the lower extremities
22			I74.5	Embolism and thrombosis of iliac artery
23			L08.1	Erythrasma
24			L59.8	Radiodermatitis, unspecified
25			M27.2	Inflammatory conditions of the jaw
26			M27.8	Other specified diseases of the jaw
27			M72.6	Necrotizing fasciitis
28			M86.311	Chronic multifocal osteomyelitis, right shoulder
29			M86.312	Chronic multifocal osteomyelitis, left shoulder
30			M86.321	Chronic multifocal osteomyelitis, right humerus
31			M86.322	Chronic multifocal osteomyelitis, left humerus
32			M86.331	Chronic multifocal osteomyelitis, right radius and ulna
33			M86.332	Chronic multifocal osteomyelitis, left radius and ulna
34			M86.341	Chronic multifocal osteomyelitis, right hand
35			M86.342	Chronic multifocal osteomyelitis, left hand
36			M86.351	Chronic multifocal osteomyelitis, right femur
37			M86.352	Chronic multifocal osteomyelitis, left femur
38			M86.361	Chronic multifocal osteomyelitis, right tibia and fibula
39			M86.362	Chronic multifocal osteomyelitis, left tibia and fibula
40			M86.371	Chronic multifocal osteomyelitis, right ankle and foot
41			M86.372	Chronic multifocal osteomyelitis, left ankle and foot
42			M86.38	Chronic multifocal osteomyelitis, other site

ICD Diagnosis | ICD Procedures | Rule Description

Ready

Prior auth just tells you:

- that this code is on the pay policy and that if you meet the documentation of medical necessity, you will receive and keep your payment.
- Does not mean that this procedure will be covered.
- Does not not mean you will get paid
- Does not mean you will get to keep what you get paid.

It is the ordering providers responsibly to meet medical necessity of the pay policy

- Has this procedure been done before
- Limitation on the reimbursement
- Usually find out when it is denied

Remember that your documentation must be for a lazy auditor who doesn’t want to pay the bill!

Safety in hyperbaric oxygen therapy environment

Education

Education

Staff

Providers

Friday, February 10, 2012

MORRISTON -- Investigators have figured out what caused a deadly explosion in Marion County, Florida killing a veterinary employee and a horse.

A hyperbaric chamber exploded at Kesmarc Equine Rehabilitation Center Friday morning. The facility is located off County Road 326, in Morriston.

Investigators said the horse inside the room, which is filled with pure oxygen under pressure, began kicking with its steel shoes to get out.

The horse managed to kick through the padding of the room to the metal walls.

The metal on metal created a spark that caused a major explosion.

Two employees were running the chamber from outside and couldn't get to an emergency switch in time.

Erica Marshall, 28, was killed. Investigators said she had worked at the facility for about two years.

Drill Type and Frequency

HBO Safety Drill Expectations

Type of Drill	Frequency
Fire in the Chamber	Annually
Fire in the Department	Annually
Fire in the Building	Annually
Exhaust By-Pass	Annually
Pneumothorax	Annually
Cardiac Event	Annually
Seizure in the Chamber	Annually
Ear and/or Sinus Block in the Chamber	Annually
Acute Claustrophobia/Anxiety	Annually
Uncontrollable Depressurization	Annually
Uncontrollable Pressurization	Annually
Loss of Communication	Annually
Loss of Power	Annually
Oxygen Supply Failure	Annually
General Fire Drills	Monthly
Doomsday Drill*	Annually

*In the case of the Doomsday Drill, at least three issues need to be occurring at the same time from the emergency flip book; I.e. fire in the building, cardiac event, loss of communication. In addition, all chambers need to be treated as if they are powered on. (Three chambers = three chambers powered on)


BARO SERV
17
EMERGENCY PROCEDURES GUIDE

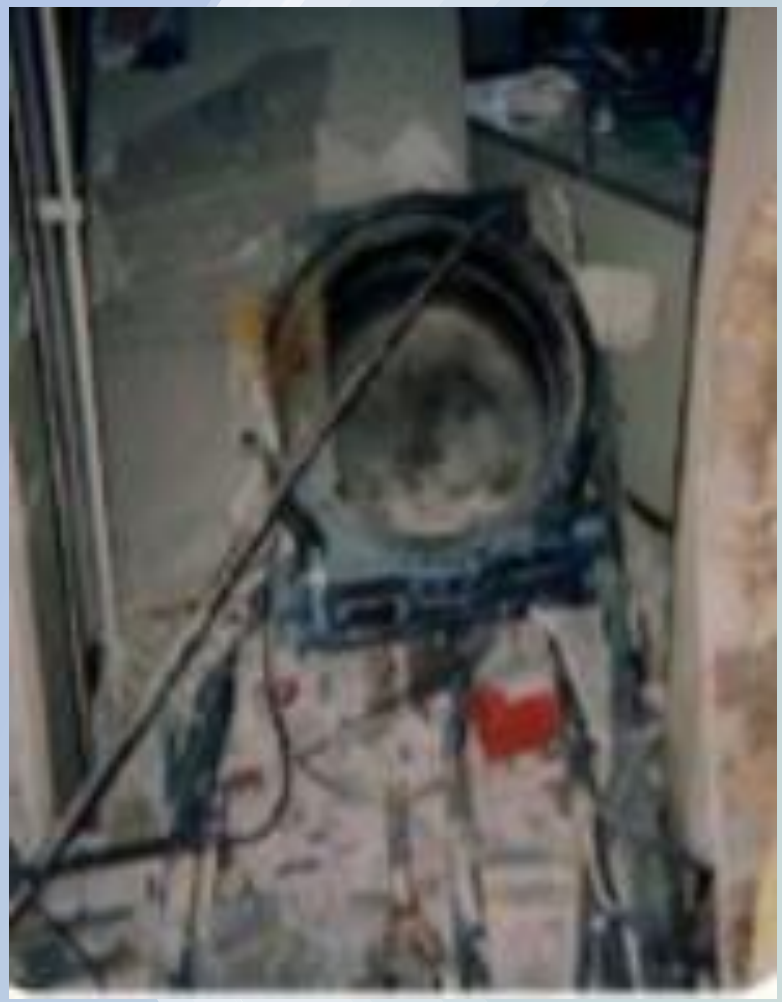
Istanbul University Medical Center, Turkey, in July 1988.

Fire broke out in their multiplace chamber and its three occupants, two decompression-injured divers and a physician attendant, perished. The chamber in question was circa 1947 vintage and not equipped with water deluge.
the subject of this fire is very much taboo

Milan, Italy

- October 31, 1997
- 11 lives lost including the Safety Director
- Ignition Source was determined to be a hand warmer.
- Fire Suppression system was non-operational

Checklist



- In 1996, a patient brought a chemical hand warmer in a monoplace chamber.
- The was no pre-survey safety check of the patient
- 1 hr into treatment at 2.7ATA, a synthetic blanket erupted into flames.
- Temperature increased to 1260 degrees Celsius with a pressure of 10.9 ATA.
- The tie rods sheared and the end caps blew.
- The patient died 12 hours later, the wife was killed and 2 passer-by's were injured.

HBO Checklist

HBO Safety Checklist

HBO DAILY SAFETY CHECKLIST

HBO Clearance:	
Health, Fear or Apprehensions Discussed:	
Understands the Risk of Treatment:	
Consent Form Signed:	
Patient Orientation Completed:	
Provider Order Completed & Signed:	

Daily Confirmation Prior to Treatment

Two Patient Identifiers to Confirm Identity:	Yes ( )
Air Mask/HEPA Filter Explained & Tested By Patient:	Yes ( )
Alcohol Avoided 12 Hours Prior to Each Treatment:	Yes ( )
All Jewelry/Metal Removed (unless covered in tape):	None ( )
All Velcro Removed (unless inactivated with tape):	None ( )
Any Battery Operated Device or Device That May Cause Spark Removed:	Yes ( )
Cologne, Deodorant, Makeup Removed:	None ( )
Contact Lenses Removed:	None ( )
Dentures/Bridge Work Removed:	None ( )
Electronic Devices Including Cell Phones, Ipods & Pagers Secured:	Yes ( )
Enzymatic Debriding Agents Removed:	None ( )
Flammable Liquids, Gases or Vapors Removed:	None ( )
Food, Candy & Gum Removed:	None ( )
Glasses (Titanium, Cerium, magesium, Prohibited) Removed:	None ( )
Ground Strap Connected, Importance of Wearing At All Times:	Yes ( )
Hair Pieces, Hair Pins Removed:	None ( )
Hair Sprays, Oils, Gels, Any Hair Care Products Removed:	None ( )
Health, Fear or Apprehensions Discussed:	None ( )
Hearing Aid / Ear Plugs Removed:	( )

KCl Bridge Dressing Removed:	None ( )
Make-up, Skin Lotions, Creams:	None ( )
Mattress Cleaned Prior to Treatment:	Yes ( )
Medications - New or Changed:	None ( )
Warming Devices Removed:	None ( )
Nail Polish / Products Less Than 24 Hrs Old:	None( )
Verified Patient Attire 50% or > Cotton Blend / No Street Clothes:	Yes ( )
Pockets Emptied:	Yes ( )
Protheses (detachable) Removed:	None ( )
Reading Materials, Tissues:	None ( )
Questioned / Searched for Hidden Objects:	Yes ( )
Sanitary Pads Removed:	None ( )
Smoking Items, Including Matches and Lighters Removed:	None ( )
Suntan Lotion Removed:	None ( )
Touch Hair to Check for Hair Spray:	None ( )
Transdermal Medication Patches Removed:	None ( )
Under Garment, Socks Removed:	Yes ( )
Valuables Secured:	Yes ( )

Miscellanous as Needed

Ace Wrap, External Ortho Fixation Devices, Casts (Dry 24 hrs), Etc. Covered:	NA ( )
Approved Implanted Devices(s):	NA ( )
Heparin Lock in Place as Applicable:	NA ( )
Ostomy Pouches:	NA ( )
Patient Voided / Foley Bag Empty Balloon Filled w/ Liquid Not Air:	YES ( )
Trachs / Foleys - See 811A Policy for Clarifications:	NA ( )

Notes

Verbalized understanding of safety checklist.Upon assessment, patient noted to be compliant with removal of prohibited items.

March 2016 Jakarta Naval Hospital multiplace chamber fire in which four occupants succumbed.

The chamber was equipped with a water deluge system yet various reports stated that “the operator tried using it, but it was too late’, “the operator failed to activate the deluge system”, “the deluge system was inoperable”, and “deluge system activated but inadequate to extinguish flames”.

“attendants might have had no courage to check whether any of them (patients) were bringing matches or cell phones in to the chamber”. This was apparently in reference to a very senior military/government official among the dead and the prevailing culture of deference. This fire had occurred at a time when one cell phone make/model’s battery had more than once generated an exothermic reaction leading to spontaneous ignition.

2002 Chinese monoplace chamber fire caused by a patient’s cell phone; one fatality

Daily maintenance:

UPMC WOUND HEALING SERVICES

VGL O2 SUPPLY WEEKLY CHAMBER CHECKLIST

CHAMBER #_____ WEEK STARTING DATE (MONDAY):_____

Daily Startup Checklist	Mon	Tue	Wed	Thu	Fri
Check and record number of Full VGL tanks (ex:3/4)	/	/	/	/	/
Designate" In Use" and" Reserve" VGL tanks					
Ensure that tanks have both supply and pressure builders open					
Check and record Main O2 line pressure at manifold	psi	psi	psi	psi	psi
Check and record Secondary O2 supply cylinder pressure	psi	psi	psi	psi	psi
Record air cylinder pressure (500 psi min). Set regulator @70-80 psi	psi	psi	psi	psi	psi
Inspect chamber door and latching mechanism					
Inspect door cam bearing surface. Clean/lube as needed					
Inspect door seal and seating surface. Clean/talc as needed					
Inspect chamber acrylics for damage and cleanliness					
Inspect chamber electrical ground lead. Tighten as needed					
Inspect chamber supply and vent hoses					
Turn on power to chamber communication and entertainment system					
Inspect control knobs for tightness and ease of operation					
Turn chamber O2 supply valve to the **OPEN** position					
Record pressure at chamber (50 – 90 psi)	psi	psi	psi	psi	psi
Inspect control knobs for damage or loose knobs					
Inspect pressure gauge and flow meter for obvious damage					
Inspect patient grounding cord and wrist strap					
Verify presence of smoke masks					
Initials of Tech completing start-up					

2001 Chinese multiplace chamber fire caused by short in air conditioner; one fatality

Weekly maintenance:

Initials of Tech completing shutdown					
Weekly Checklist and Inspections	**Date**		**Cycle #**		
Clean chamber interior and exterior including gurney					
Inspect chamber acrylic for scratches, crazing and damage					
Clean exhaust filters (wipe off with dry clean cloth)					
Disinfect air-break demand regulator assembly per policy if applicable					
Pressurize chamber to 3 ATA (look and listen for leaks)					
Check to ensure cam auto locking pin engages before 2 psi					
Verify proper calibration of set and chamber pressure gauges					
Perform timed bypass. Record time					
Test ground between pt connection and facility using Ohm meter					
Test pt ground cable assembly using Ohm meter					
Initials of Tech completing inspections					

Safety Officer Review and Sign-off: _____Date:_____

Lauderdale by the Sea

- Vickers "clamshell" chamber
- 4 year old boy with cerebral palsy and 62 grandmother who travel from Italy perished in the fire
- Suspected cause of the fire was an electrical short in the wing wall of the chamber.

Annual Maintenance

- Performed by chamber manufacturer or qualified contractor.
- Should be able to perform an acrylics inspection
- Very detailed and comprehensive maintenance should be performed to restore equipment to optimal performance.
- Should include ancillary equipment (Stretchers, Gurneys, Furniture)

FACILITY REVIEW

BARO SERV.

FACILITY NAME	
UPMC Passavant Cranberry	
DATE	**FACILITY ID#**
03/13/2018	14-0635

The purpose of this abridged inspection, performed in conjunction with chamber service, is to confirm that the chamber room meets guidelines as indicated by NFPA 99 code as well industry best practices and manufacturer recommendations. This review is not all encompassing, and facility management should continue to adhere to any and all existing policies and procedures. this review does not replace any existing policy or procedure, and is for informational purposes only. BARO-SERV, LLC does not provide any guarantees expressed or implied regarding the safety of the facility reviewed.

EVALUATION	OK	NEEDS ATTENTION	NOT AVAILABLE
The room housing the HBO unit is used exclusively as a HBOT facility	4		
Check for proper placement and installation of warning signs in the room and around the building exterior and interior	4		
Verify all electrical equipment in the hyperbaric room is properly grounded (limited only to the chamber itself and the ancillary items attached to the chamber)	4		
Verify the stringent fire precautions recommended by NFPA are being taken	4		
Verify smoke hoods are available in the HBO room and are unexpired	4		
Verify fire extinguishers are available and current	4		
Verify room sizing requirements	4		
Verify temperature of room and operation temperature of chambers	4		
Verify recommended flooring as well as maintenance of floor is in place	4		
Verify any potential heat sources near chamber	4		
Inspect for proper window treatments and that chamber is protected from direct sunlight and other ultraviolet light sources.	4		
Verify recommended lighting is currently being used in the room and over the chamber, verify all chamber lighting is supplied from only external sources.	4		
Inspect that all utility connections meet the manufacturers recommended specification	4		
Verify the required flow rate is matched with the facility supply	4		
Confirm proper zone valve size and placement within the room and exterior to the room	4		
Verify exhaust line meets manufacturer specifications as well as location and placement meet NFPA guidelines (and applicable local codes in KY, NC, VA, and MD)	4		
Confirm proper signs are posted on exterior of building near or at the exhaust outlets	4		
Confirm proper screens are installed on exterior piping	4		
Verify that patients can be removed from the chambers in the event of an emergency	4		
Verify that staff has been trained on proper use of safety devices on the HBO chamber	4		
Verify daily, weekly, and monthly chamber service logs are available for inspection	4		
Verify correct chamber leaking procedures are being employed per manufacturer and NFPA recommendations / guidelines	4		

BARO SERV.

Certificate of Inspection

THIS CERTIFIES THAT A COMPREHENSIVE PREVENTATIVE MAINTENANCE SERVICE, CALIBRATION, AND INSPECTION HAS BEEN PERFORMED ON

Hyperbaric Chamber Serial Number 36HS0018

Located at UPMC Passavant

ON THE BELOW LISTED DATE

03/13/2018

DATE

TECHNICIAN

Fatal since all six occupants survived the Geisinger Medical Center, Pennsylvania, fire in April 1989

It might prompt a decision to run a fire safety drill to test aspects of an existing fire safety plan related to factors implicated in a fire's investigative findings. Finally, it could identify chamber as built/as installed/as interconnected issues, not previously recognized, thereby leading to a degree of system "re-engineering".

Risk Assessment vs. Clinical Outcome

- Identify all possible risk
- Flammables
- Vapors, Powders, Liquids
- Ignition Sources
- Electrical Components
- Known Prohibited Items

GO NO GO LIST

Go No Go Decision Tree for Hyperbaric Oxygen Therapy

UPMC . Wound Healing Services

Ace wraps	Passavant	X			X	
adaptic	Altoona	X			X	
Adult incontinent pads/ pants	Passavant	X			X	
Air break disposable mask and tubing	Passavant	X	REMOVE METAL STRIP	X		1
Alcohol skin prep	Susquehanna	X			X	
Alcohol skin sanitizer	Susquehanna	X			X	
Alloplastic Devices (bone , breast)	Susquehanna	X		X		1
Altrazeal	Susquehanna	X		X		1
Any clothing not provided by the wound center	HAMOT	X			X	
Aquacel	Western Maryland	x		x		1
Aquacel Ag	Western Maryland	x		x		1
Batteries	HAMOT	X			X	
Blood glucose monitor	Pinnacle	X			X	
Body piercing	HAMOT	X			X	
Books/newspaper	Passavant	X			X	
bordered foam dressings	Susquehanna	X		X		1
Bras	HAMOT	X			X	
Cast padding Specialist BSN	Western Maryland	X		X		1
Catapres patches	Passavant	X			X	
Cell phone	Pinnacle	X			X	
cellular/tissue based products	Passavant	X		X		1
Cerium	Passavant	X			X	

Patient screening

Contraindications

Absolute:

- Untreated pneumothorax
- Air bubble injections in the eye

Relative:

- Chemo drugs (doxorubicin, disulfiram, Cis-Platinum, Votrient, Bleomycin, amiodarone
- Untreated lung malignancy
- Blebs in the lung's fields
- Asthma
- Implanted devices
- Pregnancy
- Previous ear surgery
- Upper respiratory infections
- Chronic sinusitis
- Active asthma
- Uncontrolled seizure disorders
- Severe emphysema and COPD with CO_2 retention
- High fever
- History of spontaneous pneumothorax
- History of thoracic surgery
- Congenital spherocytosis

Patient screening:

Chest x-ray

EXG

Pregnancy test

Tumor angiogenesis and HBO?

Evidence supports that tumors thrive in hypoxic environments.

No Surprises Act

- Law aiming to protect patients from unexpected, unwelcome, and often costly medical bills.
- The law was effective Jan. 1, 2022.
- Requires health care providers and facilities to give consumers upfront information on costs ahead of a service
- Written Coverage information:
  - Number of treatments and documentation of medical necessity
  - If applicable on coverage payment plan
  - Deductible, copay, coinsurance, tier cost
  - Must be given an estimate in written before treatment begins

Patient teaching for treatment

- Safety checklist
- No heat wraps
- No cigarettes, matches, or lighters
- No metal objects
- Manufacture clearance for all implanted devices
- No battery – powered devices
- No paper products
- No hairspray, oils, hair creams, hair products, body lotions, chapstick, fresh manicures, or any petroleum- based products
- No Sulfamylon or petroleum- based dressings
- No medication patches


For everyone's SAFETY please DO NOT take the following items into the
HYPERBARIC OXYGEN CHAMBER
Shoes
Hair gel
Jewelry
Perfume
Watches
Batteries
Hair spray
Cigarettes
Medications
Newspapers
Metal objects
Coins or money
Mobile phones
Thermal pads
Hearing aids
Lotion or oil
Electronics
Nail polish
Stockings
Matches
Make-up
Lighters
Pagers
Keys
SAFETY 1st
Any garments less than 100% cotton
Any static producing clothing or material
Anything containing oil, grease or alcohol
Anything deemed unsafe by this center
OIL

Pretreatment check

- Safety check list
- Vitals
- Blood glucose
- Lung sounds
- Heart sounds
- Tympanic membranes
- Grounding bracelet
- Air break mask

Patient Sensations

While compressing to treatment pressure:

- Feel warm
- Ears will need to be cleared every few seconds to avoid feeling full

While at pressure:

- Lie comfortable, move around, watch TV /movie, or nap
- Staff will be available at all times in the room.

While depressurizing and completing treatment:

- Cool
- Crackling sensation in the ears
- Breath normally

Possible side effects:

- Fire
- Barotraumas of the ears or sinuses
- Hypoglycemia
- Pneumothorax
- Congestive heart failure
- Oxygen toxicity
- Worsening of near sightedness (transient)
- Improvement of far sightedness(transient)
- May mature cataracts
- May develop numbness of fingers (transient)

Must provide patients with contact number for off hours.

The Joint Commission addresses hyperbaric chambers

- Environment of Care Standard EC.02.04.03
- Element of Performance 10 EC.02.03.01 and EC.02.05.01 and EC.02.05.09

Published in ***Environment of Care® News***, February 2021
Joint Commission Resources, 2021.
File Name: Hyperbaric Oxygen Chamber Compliance Checklist

APPLICABLE PROGRAM(S)
☒ AHC ☐ BHC ☒ CAH ☒ HAP
☐ LAB ☐ NCC ☐ OBS ☐ OME

Hyperbaric Oxygen Chamber Compliance Checklist

Hyperbaric oxygen therapy chambers (pressurized to a level three times that of normal air pressure) are used in medicine to treat a range of conditions, from the bends to severe wounds to infectious diseases. Two types of hyperbaric oxygen chambers are used in health care facilities: Class A (for multiple human users) and Class B (for single human users). The 2012 edition of the National Fire Protection Association (NFPA) Health Care Facilities Code *(NFPA 99-2012), which The Joint Commission references, includes a detailed chapter (Chapter 14) on safety requirements related to hyperbaric oxygen chambers.*

The Joint Commission specifically addresses hyperbaric oxygen chambers under Environment of Care (EC) Standard EC.02.04.03 (which addresses medical equipment inspection, testing, and maintenance), Element of Performance (EP) 10: "All occupancies containing hyperbaric facilities comply with construction, equipment, administration, and maintenance requirements of NFPA 99-2012: Chapter 14." However, aspects of these complex spaces are covered by other standards: fire safety training, in EC.02.03.01; utilities management, in EC.02.05.01; and medical gas management, in EC.02.05.09.

This checklist, the use of which is not required by The Joint Commission, is divided into two sections: (1) Administrative and Training Requirements and (2) Fire and General Safety and Maintenance Requirements. The checklist is not exhaustive and is not intended to be a substitute for a comprehensive training program.

Answers to all questions ideally should be **Y** *for* **Yes** *(unless marked* **NA** *for* **Not Applicable***). Use the* **Comments** *section to indicate any required follow-up action(s) identified by an* **N** *for* **No** *response.*

ORGANIZATION: _____ **DEPARTMENT/UNIT:** _____

DATE OF REVIEW: _____ **REVIEWER(S):** _____

Do the facilities that have one or more hyperbaric oxygen chambers have a designated hyperbaric safety director
who is in charge of;

- all hyperbaric equipment
- the operational safety equipment
- the operational safety requirements described in chapter 14

Does each hyperbaric facility have a designated chamber operator?

Before each run, does the chamber operator record the following information?

Attesting to satisfaction with the condition of all equipment

Does the hyperbaric safety director participate with facility management personnel and the hyperbaric physician in developing procedures for operation and maintenance of the hyperbaric equipment?

Does the hyperbarics safety director make recommendations for departmental safety policies and procedures?

Does the hyperbaric safety director have the authority to restrict or remove any potentially hazardous supply or equipment items from the chamber?

Do your organization’s leadership and governing board have rules ,regulations, and best practices related to its hyperbaric facilities?

Are the following issues addressed in the organization's policy:

- Qualifications and training of hyperbaric personnel
- Adherence to regulations and other requirements for the inspection, testing, and maintenance of hyperbaric equipment
- Controls regarding the conduct of personnel in and around hyperbaric equipment
- A description of the apparel and footwear allowed in hyperbaric chambers
- Controls pertaining to the periodic inspection of static dissipating materials

Are the following personnel familiar with the content of Chapter 14?

- Administrative professionals
- Technical staff
- Hyperbaric medicine medical director and other clinicians
- Staff involved in the operation and maintenance of hyperbaric chambers

Have the facility, medical director of hyperbaric medicine and the hyperbaric safety director of hyperbaric medicine jointly developed minimum staff qualification based on the following criteria?

- Number and type of hyperbaric chambers in use
- Maximum treatment capacity
- Type of hyperbaric therapy typically provided

Have emergency procedures specific to the hyperbaric chambers been established?

Has your organization conducted and document drills to address the following situation?

- A medical emergency in a hyperbaric chamber
- A fire in a hyperbaric chamber
- Contaminated breathing gas

Are all hyperbaric staff trained in your organization's emergency procedures?

Are emergency and fire training drills specific to hyperbaric chambers held at least annually?

Are these drills worst-case-scenario drills, with all chambers occupied?

Have all hyperbaric staff been trained on the purpose, application, operation, and limitation of specific emergency equipment?

Is a fire alarm signaling device located in the room housing the hyperbaric oxygen chambers?

Does the organization ensure that any room used for hyperbaric is not used for any other purpose?

Are signs posted at the entrance to every hyperbaric oxygen chamber that warn not to bring any flammable liquids, gases or other article prohibited by chapter 14 into the chamber?

Is the room housing the hyperbaric oxygen chambers plumbed for sprinklers, using an approved sprinkler head type with fusible elements?

In the event that air in the vicinity of the chambers is fouled by smoke or other combustion products during a fire, is a source of breathable gas allowing unrestricted mobility available outside each chamber?

In case the hyperbaric oxygen chambers and the room housing them need to be evacuated quickly during a fire are the chambers compliant with the following NFPA 99 standards for depressurization?

- Class A must be capable of depressurizing from 3 ATA to ambient pressure in 6 minutes or less.
- Class B chambers must be capable or depressurizing form 3 ATA to ambient pressure in 2 minutes or less.

In accordance with Chapter 14, are the following ignition sources/activities prohibited in the immediate vicinity of the hyperbaric oxygen chambers?

- Smoking and vaping
- Cigarette lighters, matches, and vaping devices
- Open flames
- Hot objects

Are the following potential ignition sources prohibited inside your organization's hyperbaric oxygen chambers?

- Smoking and vaping
- Cigarette lighters, matches and vaping devices
- Open flames
- Hot objects
- Personal warming devices (such as therapeutic chemical heating pads and hand warmers)
- Cell phones and pagers
- Personal entertainment devices
- Toys that emit sparks

If a chamber contains more than 23.5% oxygen, does the organization ensure electrical grounding of the patients by providing a high – impedance conductive pathway in contact with the patient’s skin (in the form of a wrist strap)?

Are the following restrictions/recommendations implemented regarding hyperbaric patients clothing?

- Silk, wool, synthetic textiles, or any combination of these materials must not be worn in hyperbaric chambers.
- Garments that are 100% cotton or a blend of cotton and polyester are allowed in chambers

Regarding medical /surgical supplies to be used in a hyperbaric chamber, does the physician or surgeon work with the hyperbaric safety director to determine which of the following normally prohibited material may be permitted in specific cases?

- Suture material
- Alloplastic devices
- Bacterial barriers
- Surgical dressings
- Biological interfaces
- Synthetic textiles

Are flammable hair sprays, hair oils, and skin oils prohibited for hyperbaric patients?

Does your hyperbaric safety director ensure that all valves, regulators, meters, and similar equipment used in the hyperbaric chambers are tested as part of the facility routine maintenance program?

Are pressure relief valves tested and calibrated as part of the routine maintenance program for your organization’s hyperbaric chambers?

Does your facility's hyperbaric safety director ensure that all gas outlets in the chambers are labeled or stenciled in accordance with the Compressed Gas Association (CGA)?

Are the chambers certified and stamped in accordance with criteria established by the American Society of Mechanical Engineers (ASME) in the safety standards for pressure vessels of human occupancy?

Does your organization maintain logs of any repairs and tests related to hyperbaric equipment?

Has your organization included in its fire response plan a process for shutting off oxygen?

Hot Topics

Office-based hyperbaric oxygen facility credentialing guidelines

UHMS position Statement

The quality of medical care given to patients undergoing HBOT should not vary by location. Office based HBOT and hospital-based HBOT providers **should follow the same guidelines set forth in previous UHMS policy statements**. In order to ensure the appropriate level of safety compliance and adherence to national standards for equipment maintenance, UHMS recommends that office-based practices obtain comprehensive periodic facility accreditation such as that offered by the UHMS.

Hyperbaric Oxygen (HBO2) Therapy as a Treatment for COVID-19 Infection- UHMS

Recommendations include a larger study/more case series that can draw conclusions regarding mortality and/or the possible therapeutic benefit of HBO2. There is a question as to whether animal studies need to be completed since this case series has already shown that treatment was successful on humans. Although this case series did not show a level of evidence that one should go out and treat COVID-19 patients with HBO2, **it does warrant a larger organized trial that is well protocolized and well designed.** This case study can be considered a feasibility report. HBO2 has been successfully used to treat patients with COVID-19, and they did not acutely deteriorate in the chamber. The questions as to whether HBO2 would **induce pulmonary edema** in these patients was not seen in this case series.

Have the protocols for cleaning the chambers and disinfection changed in light of the COVID-19 outbreak?

The UHMS HBO_2 safety committee (UHMS-SC) can provide information to assist you in answering your question, but the ultimate responsibility for these types of questions rests with the Medical Director and Hyperbaric Safety Director (MD & HSD) of your facility.
The UHMS-SC directs all hyperbaric practices to follow the guidance of the Centers for Disease Control (CDC) along with guidance from the Hyperbaric Chamber Manufacturer, State and local health agencies, and your hospital infection prevention and control group. All of these sources will impact the decision for your practice. Your choice should be a decision made between the MD & HSD of your program. The UHMS-SC can provide guidance based upon existing literature available to the public but does not endorse a particular product or procedure.
The CDC has released a list of items as identified by the Environmental Protection Agency (EPA) that can be utilized for disinfection, stating that:
“

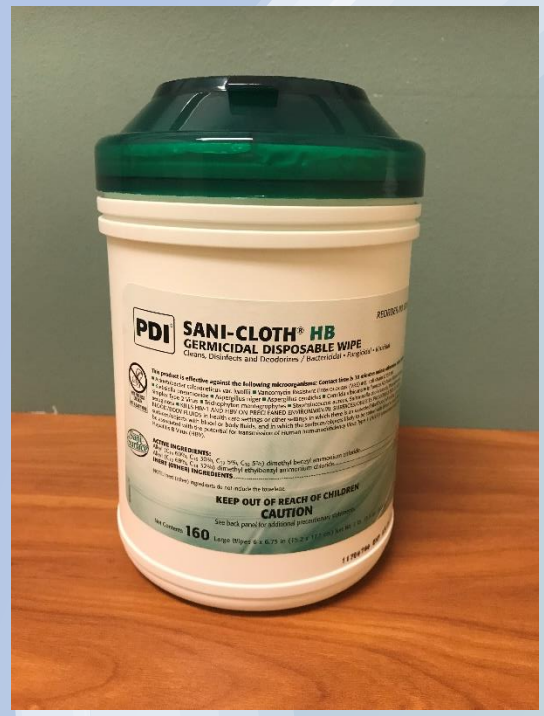
Have the protocols for cleaning the chambers and disinfection changed in light of the COVID-19 outbreak?

"Products with EPA-approved emerging viral pathogens are expected to be effective against COVID-19 based on data for harder to kill viruses. Follow the manufacturer's instructions for all cleaning and disinfection products (e.g., concentration, application method and contact time, etc.)."

It is important to note that many of the items within the EPA's list may be unsafe to utilize on acrylic surfaces. It is important to reach out to your specific chamber manufacturer for further guidance. In all cases, it is important to follow the guidance of the product's manufacturer for application and contact time.

For non-acrylic surfaces, The UHMS-SC advises you follow the guidance of your hospital's infection prevention and control department to identify a particular product that is known to be effective against COVID-19.

Regarding protocols for cleaning chamber surfaces, hyperbaric facilities should follow the protocols set forth by their institution. Dr. Jim Chimiak, Medical Director at the Divers Alert Network states: "*There are no special recommendations that we are aware of for chamber attendants or for disinfection of the hyperbaric chamber and BIBs in light of the COVID-19 pandemic. The usual disinfection protocols are more than sufficient to kill COVID-19, in the unlikely event that it would be present."*


PDI
SANI-CLOTH® HB
GERMICIDAL DISPOSABLE WIPE
Cleans, Disinfects and Deodorizes / Bactericidal • Fungicidal • Virucidal
KEEP OUT OF REACH OF CHILDREN
CAUTION
160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Net Wt. 2 oz.


novus
1
PLASTIC CLEAN & SHINE
NET 8 FL. OZ. (237 ml)
novus
2
FINE SCRATCH REMOVER
Removes Fine Scratches
NET 8 FL. OZ. (237 ml)
novus
3
HEAVY SCRATCH REMOVER
Removes Heavy Scratches
Prepares Acrylic Surfaces for No. 2 Polishing
NET 8 FL. OZ. (237 ml)

FDA recommends UHMS-accredited hyperbaric facilities for treatment of specific illnesses

In a July 26 release entitled “Hyperbaric Oxygen Therapy: Get the Facts” the U.S. Food and Drug Administration (FDA) has cleared the use of hyperbaric oxygen therapy (HBOT/HBO_2) for the treatment of several conditions. The release further states: “If your health care provider recommends HBOT, the FDA advises you get the treatment at a hospital or facility that has been inspected and is accredited by the Undersea and Hyperbaric Medical Society.”

The agency advises that individuals seeking hyperbaric oxygen therapy check with their health care provider to make sure they are pursuing the most appropriate care, noting that some facilities operate outside recognized FDA guidelines. “The FDA is aware there are some hyperbaric oxygen treatment centers promoting hyperbaric oxygen chambers for uses that have not been cleared or approved by the FDA, such as treatment of cancer, Lyme disease, autism, or Alzheimer’s disease.”

FDA-cleared conditions to be treated with hyperbaric oxygen

The FDA has cleared hyperbaric oxygen therapy for treatment in these disorders:

- air and gas bubbles in blood vessels
- anemia (severe anemia when blood transfusions cannot be used)
- burns (severe and large burns treated at a specialized burn center)
- carbon monoxide poisoning
- crush injury
- decompression sickness (diving risk)
- gas gangrene
- hearing loss (complete hearing loss that occurs suddenly and without any known cause)
- infection of the skin and bone (severe)
- radiation injury
- skin graft flap at risk of tissue death
- vision loss (when sudden and painless in one eye due to blockage of blood flow)
- wounds (non-healing, diabetic foot ulcers)

HBO_2 treatment is being studied for other conditions, including COVID-19, but has not cleared or authorized the use of any hyperbaric device to treat COVID-19 or any conditions beyond those listed above. The websites clinicaltrials.gov and the UHMS home pages at https://www.uhms.org/images/Position-Statements/HBO2_and_COVID_8-10-2020_clinicaltrials_8-12-2020.pdf have more information on hyperbaric clinical trials for COVID-19 and other conditions.

UHM Journal publishes second special edition on traumatic brain injury:

Drawing on the robust data set from the completed studies, in particular BIMA (*Brain injury and mechanisms of action of hyperbaric oxygen for persistent post-concussive symptoms after mild traumatic brain injury*) and the normative study, the authors of the papers in this second special issue present new analyses that complement the primary publications and add to the general knowledge about tools for diagnosing and measuring deficits after mild TBI, the safety of hyperbaric oxygen in this population, and the possible role of hyperbaric oxygen in ameliorating post-concussive symptoms and symptoms of post-traumatic stress disorder (PTSD).

The studies reported in this special issue are of particular importance to the hyperbaric medicine community. Hyperbaric oxygen has been proposed as a treatment for brain injury, and the studies sponsored by the United States military help to establish a safety profile for hyperbaric oxygen in the mild TBI population. In addition, the information in these papers can guide future research in this area. "**While we found significant improvement in post-concussive symptoms with 40 hyperbaric oxygen sessions in BIMA, the effect was not durable to one year and beyond. This might mean that more than 40 sessions are required for long-term improvement, but other research studies will have to answer that question,"** says Dr. Weaver.

Hyperbaric oxygen produced short-term improvement in self-reported post-concussive and post-traumatic stress disorder (PTSD) symptoms, as well as some cognitive processing speed and sleep measures, in comparison to a control group. **These improvements regressed after six months, however.** One notable finding was that improvements were most significant in trial participants suffering from both traumatic brain injury and PTSD.

•Hidden hearing deficits in military service members with persistent post concussive symptoms
A Meehan, D Hebert, K Deru, LK Weaver

•Central auditory processing disorders after mild traumatic brain injury
P Santhanam, A Meehan, WW Orrison, SH Wilson, TR Oakes, LK Weaver

•Prospective study of anxiety, post-traumatic stress and depression on postural control, gait, otolith and visuospatial function in military service members with persistent post-concussive symptoms
A Meehan, A Lewandowski, LK Weaver, D Hebert, K Deru

•Analysis of magnetic resonance spectroscopy relative metabolite ratios in mild traumatic brain injury and normative controls
PE Cartwright, TG Perkins, SH Wilson, LK Weaver, WW Orrison

•Eye tracker outcomes in a randomized trial of 40 sessions of hyperbaric oxygen or sham in participants with persistent post concussive symptoms
PA Wetzel, AS Lindblad, C Mulatya, MA Kannan, Z Villamar, GT Gitchel, LK Weaver

•Extended follow-up in a randomized trial of hyperbaric oxygen for persistent post-concussive symptoms
BB Hart, SH Wilson, S Churchill, K Deru, LK Weaver, M Minnakanti, AS Lindblad

•Adverse events and blinding in two randomized trials of hyperbaric oxygen for persistent post-concussive symptoms
S Churchill, K Deru, LK Weaver, SH Wilson, D Hebert, RS Miller, AS Lindblad

•A composite outcome for mild traumatic brain injury in trials of hyperbaric oxygen
LK Weaver, S Churchill, SH Wilson, D Hebert, K Deru, AS Lindblad

•Hyperbaric oxygen for mTBI-associated PCS and PTSD: Pooled analysis of results from Department of Defense and other published studies
BB Hart, LK Weaver, A Gupta, SH Wilson, A Vijayarangan, K Deru, D Hebert

Israeli soldiers treated for PTSD with hyperbaric oxygen therapy

Previously, treatment of PTSD has included medications and focused therapy that have had a limited effect. Nearly half of patients experience treatment-resistant PTSD.
The patients for the study were IDF veterans ages 25-60 with combat-associated PTSD that had lasted for at least four years. They arrived at the study through referrals by their psychiatrist or psychotherapist or applied after seeing advertisements that were posted in social media groups. They were then filtered according to requirements posed in a questionnaire until the researchers had a group that fit their requirements.

Is **glistening free hydrophobic acrylic material lens implants** able to go into the chamber?

•We are not aware of studies on this specific topic. We have never seen complications from hyperbaric oxygen and intraocular lenses.
•Our recommendation would be to work closely with the ophthalmic surgeon.
•Each supplier may have a recommended period of time to avoid pressure changes. This time may vary from days to weeks. Your best source of information would be found by contacting the lens manufacturer and asking about hyperbaric pressure documents.
•In practice, for anterior chamber and intraocular lens implants, **we see a 3-5 day waiting period** before starting HBO2. This is usually a limitation of the surgical procedure and not the intraocular lens material.

•Inert biological implants without a closed airspace or electrical circuits are safe, but individual consideration must be given as to the potential effects of pressure changes, We are not aware of any limitations for hyperbaric oxygen and total joint operations.

We are in need of reference materials to come up with a no/go list for our chamber. What are the best resources for this information?

- ASTM G04 Committee: Compatibility and Sensitivity of Materials in Oxygen Enriched Atmospheres
- ASTM Safe Use of Oxygen and Oxygen Systems
- Attendance and involvement in the UHMS chapter, annual meetings and pre-courses.
- Food and Drug Administration (FDA) E-mail Alerts: Manufacturer and User Facility Device Experience Database (MAUDE) https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfmaude/search.cfm
- Emergency Care Research Institute, https://www.ecri.org/Pages/default.aspx
- Hyperbaric Facility Safety: A Practical Guide, Wilbur Workman, Best Publishing
- Manufacturer's Instructions for Use statements
- NFPA 101, 2018 edition, Life Safety Code
- NFPA 53, 2016 edition Recommend Practice on Materials, Equipment, and Systems Used in OEA
- NFPA 77, 2019 edition Recommended Practice on Static Electricity
- NFPA 99, 2018 edition, chapter 14 and annex material
- Previous questions answered on MEDFAQs
- Product Manufacturer (Tech Support)
- Safety Data Sheet (SDS) (Note: these ratings apply to air environments at 1 ATA)
- The UHMS Web site, Safety Documents section contains an extended list of references: https://www.uhms.org/publications/safety-documents/safety-references.html
- UHMS Facility Accreditation Manual, 4th edition
- UHMS Guidelines for Hyperbaric Facility Operations, 2nd Edition

What is the current information on Amiodarone and HBOT?

Here is the reference and a copy of the abstract published in 2013
Franz AM, Parikh M, Derrick BJ, Logan JS, Freiberger JJ.QA Clinical Question: Does HBOT Increase the Risk of Amiodarone-Associated Pulmonary Toxicity?.2013

Background:
Investigation began after an outside physician asked: “Given the risk of pulmonary toxicity, is it safe for patients who have been exposed to amiodarone to undergo HBOT?” Amiodarone, a commonly used antiarrhythmic drug, has been shown to cause acute and **chronic pulmonary toxicity** by several mechanisms, one of which involves the production of oxygen free radicals. High levels of inspired oxygen (>50% FiO2) are believed to cause **pulmonary toxicity** by a similar mechanism. Pulmonary toxicity from standard hyperbaric treatments appears to be subclinical, with only mild reduction of pulmonary function and self-limited symptoms. The risk for development of pulmonary toxicity in patients exposed to both amiodarone and hyperbaric oxygen remains unknown.
Methods:
Patients on amiodarone during or prior to hyperbaric oxygen therapy were identified by searching the Duke Hyperbaric Medicine Database for consult notes containing “amiodarone.” Records were reviewed for pre- and post-hyperbaric treatment effects in five outcome categories: pulmonary symptoms, lung exam, chest X-ray, ABGs, and PFTs. Patients were excluded if they a) did not receive HBOT treatment, b) did not have adequate follow-up data in at least one of the five outcome categories, or c) were allergic to amiodarone. **Fifteen** patients met these criteria. Pre- and post-HBOT outcome measures were compared to determine if HBOT may have contributed to a change in pulmonary status.
Results:
Nine patients had no change in outcome measures, three had one worsening outcome measure, and three had two worsening parameters. In all patients who had worsening outcome measures, their clinical deterioration could be explained by underlying medical illnesses or acute conditions.
Conclusions: Hyperbaric oxygen therapy did not seem to add attributable risk for pulmonary toxicity in these 15 patients exposed to amiodarone. Further studies are needed to confirm the results.

Any contraindications to HBOT in patient with ventriculo/peritoneal shunt?

From a clinical perspective, it is believed to be safe treating a patient with a VP shunt. Monitor the patient for any signs of shunt malfunction and be sure that the patient's neurosurgeon is notified.

Here is the Pubmed citation:

Undersea Hyperb Med. 2000 Winter;27(4):191-4.

Ventriculo-peritoneal shunt performance under hyperbaric conditions.

Huang ET[1], Hardy KR, Stubbs JM, Lowe RA, Thom SR.

Author information

[1]Institute for Environmental Medicine, Department of Emergency Medicine, Department of Epidemiology and Biostatistics, Center for Epidemiology and Biostatistics, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania, USA.

Abstract

A **novice scuba diver** with an implanted ventriculo-peritoneal (VP) shunt inquired about the performance characteristics of his shunt while diving. A literature search revealed **no** information regarding shunt performance under hyperbaric conditions. **The manufacturer could not certify that the shunt would function under pressure.** Therefore, four VP shunts were tested according to the manufacturer's testing protocol at 1 and 4 atm abs in a multiplace hyperbaric chamber. The pressure (in mm of H2O) required to establish flow through the shunts was recorded. Trials at 1 atm abs (n = 12) and 4 atm abs (n = 12) show that **all shunts performed** within the pressure range specified by the manufacturer.

Is there a protocol for treating a patient with COPD?
There are three issues:
1.The effect of an increase in PO2 and breathing gas density on work of breathing and PCO2. Patients who have severe airways obstruction or who have chronic hypercapnia may develop **respiratory distress and elevated PCO2**, respectively.
2.Increased risk of **pulmonary barotrauma**. AGE has been reported in bullous lung disease during altitude exposure. AGE has also been reported after hyperbaric oxygen therapy ,although rarely.
3.Whether a therapeutic PO2 can actually be achieved.
In practice, at Duke University **do not administer HBO2 to patients with resting dyspnea, baseline hypercapnia or radiographically evident bullae on plain chest x-ray.** For patients with baseline hypoxemia, we use room air ABGs and a prediction algorithm to estimate whether a therapeutic arterial PO2 (arbitrarily PO2≥1000 mmHg) will be achieved.

Can patients who have pulmonary fibrosis undergo the hyperbaric oxygen therapy treatment?
There is no evidence to support HBO_2 benefiting patients with Interstitial Fibrosis. Furthermore, pulmonary fibrosis might be considered a **relative contraindication to HBO_2** as there has been at least one case report of a patient developing a gas embolism due to air trapping associated with pulmonary fibrosis. There is a published case described in the American Journal of Medicine and Pathology.

What are the recommendations/contraindications for concurrent HBO and Chemotherapy/Radiation?
This answer is from *the* recognized physician expert in the field of hyperbaric medicine dealing with oncological disease – John Feldmeier, DO.

“There is no easy answer to this question. We still struggle to answer the question of whether patients with a remote history can have HBO_2.
Although I believe that in almost all cases this would be safe. There is very little published data with concurrent therapy. **The issue of concurrent chemo/ HBO_2 has next to no published information and really has become a fairly recent issue because patients are now living longer with active malignancy**. There are more and more options for systemic treatment and quality of life issues are pertinent for patients even when they have active disease

The scenario where this becomes an issue is when a patient has had prior radiation, has a complication, needs HBO_2 but is receiving chemo probably because recurrent or residual cancer has been found.

Chemo comes in many varieties with traditional cytotoxic drugs in at least 8 categories and now with more options including immune therapies and anti-angiogenic therapies. It is impossible to make a universal recommendation applicable to all chemotherapies.

Some of these drugs mediate their anti-tumor response through free radicals which cause chemical bond breaks in the DNA leading to reproductive death. Some are antibiotics: some are spindle cell blockers etc., etc. Those that mediate cytotoxicity through free radicals are likely to have their effect enhanced in the tumor and normal tissues.

This was the basis of using HBO_2 as a sensitizer to radiation done from late 50's to early 70's. Since the therapeutic goal is to enhance QOL, this would not be perceived as an appropriate effect.

Eric Kindwall's book declares there to be a **contraindication to Adriamycin and Cisplatin. This precaution is based on pretty weak evidence**. On the other hand Dick Clarke has done a preliminary study with colleagues at U of Chicago **using HBO2 along with Cisplatin and radiation without signs of increased toxicity**.

The concerned is about **Bleomycin and Avastin**. Jake Freiberger, MD of Duke U. has reviewed their experience in treating patients with a PAST not concurrent history of Bleomycin exposure without a **demonstrable ill effect. Do not give Bleo concurrently with HBO_2**. **Avastin** and some of the other so called biologics (Erbitux) **target growth factors including VEGF** to exert their effect. Since we enhance **VEGF with HBO_2 are we diminishing the anti-cancer effects of Avastin? Will HBO2 be effective if VEGF is being suppressed by the Avastin? We don't know.**

Operational recommendation is:

1)To avoid chemo and HBO concurrently whenever possible.

2) If you do give concurrently wait a few half-lives perhaps 4 or 5 to see serum levels significantly lowered before resuming HBOT after each chemo administration. Half-lives for all the drugs are published. Avastin is 60 days!!

3) Avoid Avastin and some of the other biologics as well as Bleomycin as concurrent therapies.“

Knowledge of clinical circumstances or literature regarding having a patient with a 20+ year old **mechanical aortic valve** undergo HBO2.
The valve has not been pressure tested by the manufacturer?

There are no pressure-sensitive components in a mechanical valve, since it contains no gas pockets. There are no issues with respect to hyperbaric oxygen therapy regarding a prosthetic valve.

Is history of **retinal detachment with prior surgery** a contraindication to HBO?

History of retinal detachment and surgery is an **absolute contraindications to HBO_2 during the in the initial post-operative period to allow time for gas resorption,** which it is approximately 3 weeks. It is recommended to have a follow up appointment with the ophthalmologist prior to being treated in order to make sure the gas is resolved.

We have a patient needing to start HBO2 but does peritoneal dialysis at night and states that there is about a liter of fluid left in his abdomen during the day. Would it be safe to treat the patient with that much fluid?

There is no risk of having 1 L of fluid in the peritoneal cavity.

A patient has completed 120 treatments at another facility and presents to our facility for a second opinion and further treatments? What is a safe number of treatments to administer?

- What is the quality review/recommended number of treatments for the diagnosis?
- What will the reimbursement be?
- What is medically necessity

What are your policies on vital signs? Do you take vital signs before and after the treatment? What is the standard of care?

The standard of care is that patients are assessed by a licensed personnel before they are treated and then again when the patient completes the treatment. This includes blood pressure, pulse, respirations, lung sounds, cognitive status, skin status, blood glucose level (if the patient is diabetic), etc.

It's also an expectation of insurance companies including Medicare that the **patient is assessed as part of the billable occurrence.**

Does **Raynaud Syndrome** with non-healing ulcers qualify as an indication for HBOT?

In the past, there has been several collagen-vascular disease patients treated, some with Raynaud's, anecdotally with HBOT for digital ulcers. Most had improvement or complete healing. Most were treated, in conjunction with the rheumatologist, with a phosphodiesterase inhibitor. Each patient a "test" HBOT exposure to ensure the hyperoxic vasoconstriction didn't make them symptomatically worse. If not, proceeded with treatment. If so, HBOT was not offered
In the U.S., **it is not insurance-accepted diagnosis that can be used to treat Raynaud's patients currently. In** the past, were able to use acute peripheral arterial insufficiency as a category. That has long since been discontinued.

What is the status of treating a patient with pulmonary hypertension due to severe tricuspid regurgitation or anyone with pulmonary hypertension?

Oxygen is a pulmonary vasodilator and hyperbaric oxygen tends to decrease pulmonary vascular resistance
(see http://www.ncbi.nlm.nih.gov/pubmed/12042776). Pulmonary hypertension could be a cause of tricuspid regurgitation, but not the other way around.
We must treat quite a number of individuals with raised pulmonary vascular pressures, although roaring TR would be less common. I would think there is no specific contraindication but would have a high level of vigilance for both r and l heart failure on hyperoxic exposure. I would monitor both ECG and ABGs at least on first exposure and would be reluctant to consider monoplace treatment. I would reconsider the wisdom of treatment if there we any indications of a failing heart on echo.

In regard to the 30-day conservative management of ulcers prior to initiating HBO in Medicare patients. My LCD which is Novitas, requires me to document that the patient has had at least 30 days of conservative ulcer management that has failed to heal or improve the ulcer, prior to starting HBOT. My question is if the ulcer is deteriorating with this conservative management, can I start HBO sooner and still get it covered.

HBO_2 **may not be initiated** until a full 30-days of failed care has been demonstrated. Care must be taken to ensure that all aspects of "conservative" management have been optimized during that 30-days, **otherwise the time does not count as "failed" for purposes of HBOT**.

The **HPI** (History of Present Illness) must contain **specific details** and timelines of the various conservative treatment methodologies attempted to heal the wound in **the past 30 days** to include:

•Description of the wound's response to each **attempted specific treatment**

•Timelines of each intervention -or specific procedure, reason and **outcome** both positive and negative

•If there is **an infection**, identify the organism, method used to obtain the specimen, identify the **antibiotic** prescribed, dosage, method of administration with timeline and response.

•Include all antibiotic changes or adjustments with dosing and why
For instance, if the **vascular status** or **nutritional status** had not been evaluated and optimized during 30-days of care, Novitas does not consider this to meet the 30-days of failed care requirement.

We are assuming that you mean the patient has already met the Wagner Grade 3 indication and that osteomyelitis is present as part of the overall diagnosis including a lesion with infection of the tendon or tendon sheaths, abscess of plantar surface, proven osteomyelitis before they have surgical intervention.

Experience has demonstrated **that if site of an ulcer has been amputated, Medicare believes that the osteomyelitis no longer exists.** So, applying this rationale to the question about a Wagner Grade 3 wound being amputated, technically the patient no longer has a Wager Grade wound because it's now a post-operative site and HBO2 would be ceased for that indication.

If the Wagner Grade 3 wound and bone is debrided, then you would need to continue to follow the guidelines for use of HBO_2 post-operatively. There would have to be documentation supporting the need to continue HBO_2, in the form of diagnostic test results and progress notes more substantial than simply exposed bone at the open amputation site.

From a Medicare perspective, **exposed bone is not sufficient to support the presence of osteomyelitis.** There are a lot of varied opinions related to this circumstance within the hyperbaric specialty. As for debridement, that would depend on how extensive the debridement was that had been performed and how well the physician progress notes substantiated the ongoing presence of osteomyelitis. For example, **if only a limited debridement was performed the progress note would ideally make it clear as to why complete debridement of the bone was not possible and the plan to continue HBO2 to augment debridement efforts.**

This will include routine ear assessment (pre/post-ascent) as injury can occur in the absence of a patient's complaint. Auto-inflation technique(s) should be taught and demonstrated, patient compliance attempts observed, preferably including otoscopic exam, during initial hyperbaric consultation. Encouraging frequent auto-inflation during compression tends to pay dividends. Patients should be observed during all pressure changes and advised to promptly report ear discomfort.

Wigs are not allowed in the chamber. What about hair extensions both synthetic and/or real hair? If not allowed, why not?

Synthetic hair is a very fine plastic filament. **It can be composed of various fiber types, some of which have concern for HBO.** For example, Kanekalon is a modacrylic fiber made of PVC composition filaments which is flammable and lacks heat resistance.
Other types such as Future can withstand heat up to 400 degrees.

- Hair products get placed in a variety of ways including...
  Weave (sewn into hair and only detached by removing the sewing)
  Clip-in or clip-on (least permanent and easy to remove)
  Bonding and sealing extensions (bonding chemicals have adhesive that off-gases and is flammable in HBO environment)
  Fusion (uses very flammable keratin adhesive)
  Micro rings (uses small metal rings)
  Tracking (braiding of natural hair and then sewn)

Many of these products have flammability and static potential. Static potential might be mitigated by wrapping a damp towel around patient's head (if it cannot be removed), but **flammability concern could still exist.**

Transdermal medication delivery systems (medication patches) are used to treat medical conditions, including hypertension and chronic pain, that are common in patients receiving hyperbaric oxygen therapy. The safety of these medications in the hyperbaric chamber has not been formally analyzed.

However, a structured literature search has been conducted to identify all published case reports and human and animal experiments relating to these safety concerns. Analysis of the potential for creating fire in the hyperbaric environment was performed using standard chemical and hazardous materials references and formulae at a range of standard appropriate hyperbaric treatment protocols.
In addition, relevant data were obtained from product manufacturers.
Transdermal medication delivery systems appear to present a low risk of fire in both 100% oxygen pressurized monoplace chambers and in multiplace chambers. Each medication patch should be analyzed based on its individual makeup, and users should investigate to make sure said patch does not contain alcohol or crude petroleum based ingredients.

However, the direct effect of pressure changes on the patch and alterations of skin perfusion due to hyperoxic vasoconstriction, adiabatic heating, and adiabatic cooling significantly alter medication absorption, and should be considered. There is less drug delivered during compression, and more drug released during decompression. This is not clinically significant in the hemodynamically stable traditional wound care patient being treated in the chamber.

Conclusions: Transdermal medication delivery systems do not produce a fire risk in the hyperbaric environment. However, because of erratic drug absorption, this should be noted. There is no reason to apply a primary dressing over the patch.

Patients who are allergic to the drug contained in the patch or patients allergic to the adhesives used in the assorted patches of course should not use said patches.

References:

Physician Desk Reference, Thomas PDR at Montvale, NJ

Undersea and Hyperbaric Medical Society, Inc. (www.uhms.org), Lavonas, EJ, "Safety Analysis of Transdermal Medication Delivery Systems In The Hyperbaric Environment"

This Alert is being issued due to a potential new type of product hazard, which on specific hyperbaric patients would actually **introduce saturated alcohol pads attached to patient's intravenous lines**. These are catheters used to fight off Central Line Associated Bloodstream Infections (CLABSIs) by incorporating alcohol sponges.

The Curos® Port Protector (one example of this type of potential hazard):

- Reliably and consistently disinfects luer-activated access ports
- Simply peel off the seal and twist Curos® Port Protector disinfection cap over the top of a luer-activated I.V. access port. Inside this revolutionary green cap is a 70% IPA (isopropyl alcohol) saturated sponge-like foam. Once secured, the Curos Port Protector automatically provides effective, consistent and reliable passive disinfection of the port.

SwabCap® is a disinfection cap that covers the needleless connector and protects it from touch and airborne contamination after it's been applied. SwabCap **contains 70% Isopropyl Alcohol** (IPA) as a disinfectant solution and when applied to the needleless connector, between line accesses, **the IPA bathes the connector's top and threads.**

The above port caps are examples of a new product that is used to disinfect and protect port access adaptors or luer-lock areas from contamination as described by their website excerpts that follow them.

As these caps use an alcohol soaked sponge as part of the cap assembly, all wound care and hyperbaric staff members now need to be aware of the potential for our hyperbaric patients to present with the use of these your-asthma-info.com.

The following precautions should be considered for implementation:

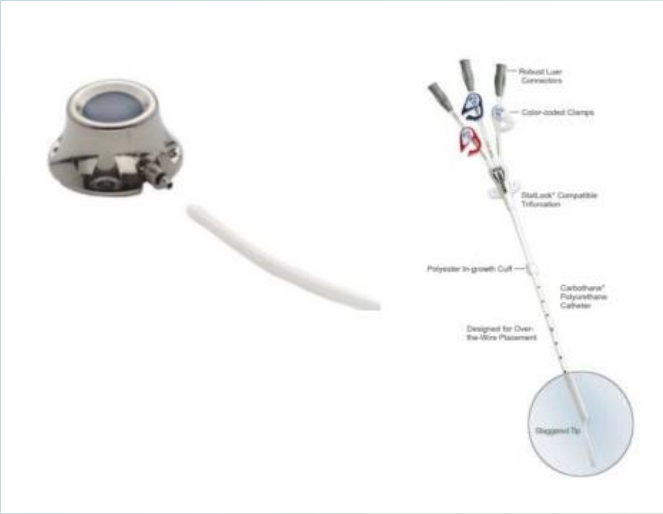
• New HBO candidates should be assessed for the presence of **any port cap** of this type, starting with any RN staff involved with the patient, and HBO staff alerted effectively. Only staff allowed per local Hospital policy, should be providing care to these peripheral or central intravenous lines; meaning, disconnecting, flushing, or reconnecting/replacing lines with other caps or plugs.

• If found or not, consider notifying other caretakers of the need to stop or not start use of these port protectors during the duration of the patient's HBO treatments. HBO staff shall be in-serviced by an RN on the need to question and inspect the patient for any ports (or new ports) and potential caps of this type on a daily basis as part of the safety check, as even a patient with or without ports, could present with a port(s) at any time,

• If these alcohol disinfecting caps are found on any port access adapter or closed luer-lock, **they are to be removed, discarded, and the ports and their lines secured.** (One example we have seen, but not the only, are Port- A-Cath, Triple Lumen Catheters, PICC Lines). If these type caps are found on an open (communicating) luer-lock, they are to be removed and immediately replaced with an appropriate non-alcohol impregnated cap or fitting. If a quick look at the inside of a cap reveals no presence of a material that could hold alcohol, the cap can immediately be replaced. The patient should also be informed of the reason for removal and need to advocate for its' non-use while being treated with HBO.
• Note: Although it may be common for you to see port caps in place (standard or now alcohol impregnated), port caps are not necessarily required, as the normal standard of disinfecting the port with alcohol before use, would be used if a standard cap was in place or if the cap is not in place. But each center will need to determine the need to replace the removed cap with a new one of the same type after the HBO treatment.
• We understand the need for controlling nosocomial infections, and the system may be valuable in the 1 ATA world, **but under pressure breathing 100% oxygen, this type product presents a hazard.**

Concerns arise when preparing patients with peripheral IV lines, central lumen catheters, triple lumen catheters, PICC lines, or Port A Caths, for their hyperbaric treatments. If you are not infusion intravenous medications through these catheters during the hyperbaric treatment, these IV lines are easily prepared for introduction into the chamber.

- Peripheral IV lines need to simply be re- sealed or capped.
- The stopcocks on triple lumen catheters or central lumen catheters need to be all in the “off” position.
- There is no preparation for Port A Caths.
- PICC (Peripherally Inserted Central Catheters), also just need to be sealed, clamped, or capped in place.



Some of these IV lines have extra lengths of catheter tubing extending from these anatomical sites. You should gather **that extra tubing length and just tape the tubing securely** to the patient area so the patient does not inadvertently pull on them to dislodge them. As the patient moves around in the chamber, we don't want that tubing to get caught on something and become disrupted.

There **is no reason to have to flush** these catheters that come to you already capped. They have been flushed either by the patient or the Nurse in the home setting when applicable. Conversely, there is no reason to have to flush said catheters after the hyperbaric treatment is complete.

Monoplace Chamber Cam Latch Problem

Occasionally there have been reported cases of a chamber door that failed to open upon completion of a hyperbaric treatment. This has been observed in several chamber manufactures. It is important that all chamber operators be fully aware of the proper actions to take should this problem occur in your chamber at your Center.

There are a few likely scenarios that could cause difficulty in opening the chamber door.
Operator Error – The most frequent occurrence is a jammed cam latch pin, caused by trying to rotate the latch handle before Chamber Pressure has been fully vented.
Cam Latch Pin Will Not Retract–The cam latch pin may get hung-up on the inner wall of the camshaft thru-hole, even when the Chamber Pressure has been fully vented.
Note: If Safety Lock Pin becomes jammed and does not retract, make sure the Chamber Door and Swing Arm Assembly Lever are in the fully closed position. If Safety Lock Pin still does not retract, insert a blunt instrument through the hole in the Swing Arm Assembly to disengage the Safety Cam Latch Pin. Do not use something that could break in the hole such as a writing pen or pencil.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EMERGENCY PROCEDURES GUIDE

Monoplace Chamber Cam Latch Problem

Cam Latch Pin Cannot Retract – In the event of a malfunction in certain components, the signal pressure to the latch cylinder may not properly vent. This can cause the cam latch pin to stay in the extended position, preventing the chamber door from being unlatched even though chamber pressure is at zero. **Note:** If pushing against the stuck pin does not make it immediately retract, then there probably is still pressure being supplied to the latch cylinder. The surest way to vent that pressure is to cut the small, single diameter tubing that leads to the latch cylinder! The sticky characteristic of that tubing, together with the extremely tight fit on that hose barb, makes it very, very difficult to simply pull off. It is quicker and easier to cut the tubing! Please cut it cleanly, and as close to the barb fitting as possible (You will have to reconnect this tubing once we correct the component malfunction). Once the latch cylinder has been vented, the cam latch pin should retract. Unlatch and open the chamber door.

References:

Sechrist Industries User Manual, Sechrist Industries, Inc., 4225 La Palma Avenue, Anaheim, CA 92897 USA
O&M Sigma 34, Perry Baromedical Corp., 3660 Interstate Parkway, Riviera Beach, FL 33404


TEST POINTS

Treatment of Frostbite With Hyperbaric Oxygen Therapy

The cohort consisted mostly of men (18, 81.8%) and patient mean age of 40 years (range, 13-70 years). Ten patients (45.5%) were intoxicated at the time of injury, and psychiatric illness was implicated in 9 (40.9%) patients. Of the presented injuries, 17 (77.3%) had frostbite to the upper extremity. Bone scans were performed on 16 (72.7%) patients. In 4 patients, the absence of radiotracer activity correlated with a protective effect on subsequent amputation levels. All patients received anticoagulant therapy. Of the 22 patients, 16 (72.7%) experienced at least 1 side effect of HBOT, including otologic barotrauma, nausea, vomiting, anxiety, oxygen toxicity seizure, and myopic changes. **All study patients recovered without permanent sequelae; it is unclear whether HBOT reduced soft-tissue damage or amputation rates.**

Treatment of Frostbite With Hyperbaric Oxygen Therapy: A Single Center's Experience of 22 Cases - PubMed (nih.gov)

CVA-

The UHMS is aware of current interest in the use of HBOT for treatment of cerebral vascular injury. Data currently available include a number of individual case reports, some small case series, and one prospective randomized trial. While the results from these case reports and case series **tend to suggest a beneficial role for HBOT therapy in cerebral vascular injury, found no benefit of HBOT treatment**. Since prospective randomized trials are generally accepted to be the most reliable form of clinical research, the weight of the currently available scientific literature is not felt to support an endorsement of HBOT for cerebral vascular injury.

Hyperbaric oxygen therapy for acute coronary syndrome

For people with ACS, there is **some evidence from small trials to suggest that HBOT is associated with a reduction** in the risk of death, the volume of damaged muscle, the risk of MACE and time to relief from ischemic pain. In view of the modest number of patients, methodological shortcomings and poor reporting, this result should be interpreted cautiously, and an appropriately powered trial of high methodological rigor is justified to define those patients (if any) who can be expected to derive most benefit from HBOT. **The routine application of HBOT to these patients cannot be justified from this review.**

Bennett MH, Lehm JP, Jepson N. Hyperbaric oxygen therapy for acute coronary syndrome. CochraneDatabaseofSystematicReviews 2015, Issue 7. Art. No.: CD004818. DOI: 10.1002/14651858.CD004818.pub4

Podiatry supervision of HBOT

- It is paramount that the provider holds a **broad base of global medical expertise to be able to anticipate, identify, mitigate and treat potential systemic complications.**

- The UHMS PATH (Program for Advanced Training in Hyperbaric Medicine) program was created to enable MD/DOs and *physician assistants (PAs) and nurse practitioners (NPs) to attain additional mentored education and distinction in UHM.*

- *Given that doctors of podiatric medicine (DPMs)* ***are not medically trained to manage systemic medical conditions, complications, or side effects of HBO2, they are not eligible for enrollment in the UHMS PATH program.***

Podiatry supervision of HBOT

- ***The Scope of Practice for a physician supervising HBOT must include all components of patient evaluation necessary to evaluate the potential HBOT recipient and to ensure that there is no relative contraindication to treatment.*** *The physician supervising HBOT should be both cognizant of the potential hazards of the therapy and have the capability to provide appropriate treatment of the complication should it arise.* ***Supervising Physician's documented training shall include the experience and expertise necessary to diagnose and treat the established complications of HBOT occurring while the patient is under his care. These potential complications include tension pneumothorax, respiratory decompensation secondary to aspiration, seizures, acute tympanic membrane injury, signs of oxygen toxicity and hypoxia as well as differentiation of these problems from anxiety or claustrophobia.*** *All potential treatment of medical and surgical emergencies arising in the patient receiving HBOT must be within the scope of practice of the physician providing supervision.*

Crohn's disease

There are numerous small case series reporting the results of hyperbaric oxygen in the treatment of inflammatory bowel disease (Crohn's and Ulcerative Colitis). Typically, these are positive in results for a majority of cases often including patient's refractory to pharmacologic treatment and in Crohn's including patients with fistulae.

Crohn's disease

Some investigators have used HBOT to treat inflammatory bowel disease (IBD), including Crohn’s disease and ulcerative colitis. Comprehensive searches were conducted in 8 scientific databases to identify publications using HBOT in IBD. 19 were found.

Crohn's disease

Human studies and animal models were collated separately.
Results: 13 studies of HBOT in Crohn’s disease and 6 studies in ulcerative colitis were identified.
In all studies, participants had severe disease **refractory to standard medical treatments**, including corticosteroids, immunomodulators and anti-inflammatory medications.

Crohn's disease

In patients with Crohn’s disease, 31/40 (78%) had clinical improvements with HBOT, while all 39 patients with ulcerative colitis improved.
One study in Crohn’s disease reported a significant decrease in proinflammatory cytokines (IL-1, IL-6 and TNF-alpha) and one study in ulcerative colitis reported a decrease in IL-6 with HBOT.
Adverse events were minimal.

Crohn's disease

Four animal studies reported **decreased edema** or colonic tissue weight with HBOT, and 8 studies reported **microscopic improvements** on histopathological examination. Although most publications reported improvements with HBOT, **some studies suffered from limitations**, including possible publication and referral biases, the lack of a control group, the retrospective nature and a small number of participants.
Conclusions: **HBOT lowered markers of inflammation and oxidative stress and ameliorated IBD in both human and animal studies**. Most treated patients were refractory to standard medical treatments. **Additional studies are warranted to investigate.**

Rossignol Medical Gas Research 2012, 2:6
http://www.medicalgasresearch.com/content/2/1/6 the effects

Hyperbarics and septic shock

Researched by Dr. Dennis, Dr. Mohr and Dr. Bailey

Animal studies have demonstrated :

- Retore mitochondrial function
- Improved microvascular function and organ perfusion
- Enhanced antibiotic function

Administered early and in high doses

Recommended to investigate with human trials

Baro Serv can provide information, but the ultimate responsibility for these types of questions is the medical director and safety director of your facility. Addressing a bed bug contamination is not unique to hyperbaric chambers and we would encourage you to follow the infection control procedures of your institution. This is a serious issue, none of us want to be part of a hospital-acquired bed bug infestation. **We encourage you to work with cleaning products that are outlined on the chamber manufacturer cleaning productivity list only to remain safe and compliment within the oxygen environment of a chamber. That can be found here: http://www.baroserv.com/page6.html** *We are aware of at least one facility that lost a monoplace chamber due to an exterminator using steam on the acrylic. The use of steam to clean a bed bug infestation in the monoplace chamber is not advised. ASME PVHO-1 acrylic is a low-temperature product and commonly rated for a minimum of around 50 degrees F and a maximum of about 125 degrees F, depending on design or manufacturer.*

Things to consider:

- Post-treatment; inspect the chamber with a high lumen flashlight. You are looking for black specs or moving bugs.
- Post-treatment; don appropriate personal protective equipment to keep bugs from attaching to you, then enter the chamber and remove bugs by wiping and consider vacuuming the mattress, pillows, and area between the seal and acrylic. Remember – they do not jump.
- Post-treatment; inspect the chamber mattress with a high lumen flashlight. You are looking for black specs or moving bugs. Also, examine the folds, creases, and zipper flaps of the mattress.
- Post-treatment cleaning of the hyperbaric suite: The Hyperbaric Safety Director should be present to oversee the cleanup of the hyperbaric suite. Extreme care is to be used around the acrylic.
- Cleaning solutions and disinfectants, approved for hyperbaric chambers, do not kill bed bugs. Instead, the best method of elimination from inside the chamber is by removal.
- Inform the hospital cleaning staff or exterminators that steam cleaning is not to be performed on the chamber's acrylic windows as steam will severely damage the acrylic.
- Inform the hospital cleaning staff or exterminators that cryogenic fluids are not to be used on the chamber's acrylic windows, as the extreme cold will damage the acrylic.
- If possible, treat this patient in the last treatment block of the day; this will allow for the extending cleaning and inspection time without interfering with the other scheduled treatment times.
- Also, ask the hospital's exterminator for a protective mattress liner. For example, ActiveGuardMattress* Liner.
  - ActiveGuard is intended to be placed on a mattress and left on for eight weeks and up to two-years depending on the severity of infestation or presence of bed bugs.
- ActiveGuard has a chemical that kills dust mites and bed bugs, but the liner itself will need to be evaluated by the HBO2 Safety Director and Physician in Charge for acceptance during a treatment. One option is to place the liner on the mattress at the end of the day's treatments and remove the linen just prior to the next day's treatments. (ActiveGuard is mentioned as this is the only mattress liner known to Baro-Serv as one that kills bed bugs.