NEW UPDATES IN ANESTHESIA FOR DIFFERENT TYPES OF WEIGHT LOSS SURGERY

Essay

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Listofabbreviations

- A-aDO2 Alveolar-arterial oxygengradient
- AF Atrialfibrillation
- AGB Adjustablegastric banding
- AHA American Heart Association
- AHI Apnea/hypopneaindex
- ATBF Adiposetissue blood flow
- BMI Bodymass index
- BPD-DS Biliopancreaticdiversion withduodenal switch
- CAD Coronaryarterydisease
- COX-2 Cyclooxygenase2
- CPAP Continuous positive airwaypressure
- CT Computed tomography
- DJD Degenerativejoint disease
- ECG Electrocardiogram
- EEG Electroencephalogram
- EMG Electromyogram
- FEV1 Forcedexpiratoryvolumes in one second
- FFA Freefattyacid
- FVC Forcedvital capacity
- GERD Gastroesophagealrefluxdisease
- GOJ Gastroesophageal junction
- HC Hip circumference
- HDL High-densitylipoprotein
- HELP Head elevated laryngoscopyposition
- IBW Ideal bodyweight
- LAD Leftatrial dilatation
- LAGB Laparoscopic adjustablegastricband
- LBW Lean bodyweight
- MetS Metabolicsyndrome

- MO Morbid obesity
- MRI Magnetic resonanceimaging
- NCEP National Cholesterol Education Program
- NIH NationalInstitutes of Health
- NIV Noninvasive ventilation
- ODI Oxygendesaturation index
- OHS Obesityhypoventilation syndrome
- OSA Obstructivesleep apnea
- PACU Post-anesthesia careunit
- PCO2 Partial pressureof carbondioxide
- PEEP Positive end expiratorypressure
- PO2 Partial pressureof oxygen
- PONV Postoperativenausea and vomiting
- RA Regional anesthesia
- RAAS Renin-angiotensin-aldosteronesystem
- RYGB Roux-en-Y gastric bypass
- SAT Subcutaneous adiposetissue
- SG Sleevegastrectomy
- T2DM Type2 diabetes mellitus
- TBW Total bodyweight
- TV Tidal volume
- VAT Visceraladiposetissue
- VBG Verticalbandedgastroplasty
- WC Waist circumference
- WHO World health organization
- WHR Waist/hipratio
- WHtR waist toheight ratio

Introduction

Obesityisamajorhealthproblemworldwideandhasreachedan epidemicproportionintheWesternsociety.Evidencecontinuesto accumulatethatobesityisamajorriskfactorformanydiseasesandis associatedwithsignificantmorbidityandmortality***(Sjostrometal.,2012).***

Pathophysiologicalchangesofobesityrangefromairwaymanagement difficultiesandchangesindisturbancesinrespiratoryphysiologytomany diseasesasdiabetes,hypertension,andheartdisease.Morbidityrate increasessubstantiallywithincreaseinbodyweight,withsubsequent increaseinrisksofhypertension,diabetesmellitus,coronaryarterydisease, dyslipidemia,gallbladderdisease,osteoarthritis,respiratoryproblems,and cancersofvariousorgans.Relatedrisksaresurgicalandmedical***(Domiand Laho,2012).***

Surgicaltherapyforobesity(bariatricsurgery)istheonlyavailable therapeuticmodalityassociatedwithclinicallysignificantandrelatively sustainedweightlossinsubjectswithmorbidobesityassociatedwith comorbidities.***(Sjostrometal.,2012).***

Bariatricsurgerycanbedividedinto3categories:restrictiveprocedures thatreducetheabilitytoconsumelargeamountsoffood,malabsorptive proceduresthatreduceintestinaluptakeofnutrients,andproceduresthat combinethese2aspects***(Meijeretal.,2011).***

Bariatricsurgerycanbeperformedlaparoscopically(viaasmallincision intheabdomen)orusinganopenprocedure(i.e.laparotomy).***(Reochetal., 2011).***

Theobesepatientpresentsparticularchallengesfortheanesthetist.The objectiveofpre-operativeassessmentistooptimizepatientoutcomes.It facilitatestheappropriateselectionofpatientssuitableforbariatricsurgery, enablestimelyidentificationandtreatmentofpreexistingmedical conditions,anddeterminehowandwhereeachpatientshouldbemanaged postoperatively***(O'NeillandAllam,2010).***

Perioperativemanagementischallenging.Itiscenteredaround cardiorespiratoryandmetabolicoptimization,minimizingadverseeffectsof painandsystemicopioids,effectiveuseofregionalanesthesia,andan emphasisonmobilizationandnutrition.Thereisariskofincorrectdrug dosinginobesity,whichrequiresanunderstandingoftheappropriatedosing weightsfor perioperativemedications***(Cullen andFerguson, 2012).***

Bariatricpatientsareatincreasedriskofbothearlyandlatepostoperative complications.Initialpost-operativeconsiderationsincludeairwayand respiratorysupport,paincontrolandpreventionofthromboembolism ***(O'NeillandAllam,2010).***

Aimofthework

ThisEssayaimstoprovideacomprehensivereviewoftheanestheticmanagementoftheobesepatientundergoingbariatricsurgerywithspecialreferencetorecentadvances.

PathophysiologyofObesity

Whatisobesity?

Obesityisdescribedanatomicallyasanelevatedleveloffatstorageinthe formofhypertrophy(increasedsize)and/orhyperplasia(increasednumber) of fatcells,knownasadipocytes.

Giventhecomplexitiesofbody compositionanalysis,thebodymassindex ***(BMI)***actsasasurrogatefortheamountofbodilyfatandfacilitatespatient comparisonandgroupingforthepurposesofresearchordiscussion.Body massindexisdefinedasthebodyweightinkgdividedbythesquareofthe bodyheight inmeters***(kg/m2).***

BMI=body weight(in kg)/height^2(inmeters)

ObesityhasbeendefinedasaBMI<30kg/m2,andmorbidobesityhas beenreferredtoasaBMI<40kg/m2oraBMI<35kg/m2withanobesity-relatedcomorbidity(table1).Bodymassindexaloneisnotagoodpredictor ofthedistributionofexcessbodyfat***(adiposity)***;centralobesitywith elevatedvisceralfatlevelsisassociatedwithgreatermetabolicimpactand complicationsthanwidespreadsubcutaneousfat.Bodymassindexmaybe misleadinginpatientswithsignificantmusclebulk.Itisalsocriticalto understandthatpatientscanhaveelevatedbodyfatcontentdespiteanormal BMI,so-called***''normalweightobesity''***,andthistoocanhaveanimpact onorganfunction***(Kosmalaetal.,2012)***.

Weneedtomoveawayfromtheconceptofmeasuringanddiagnosing obesitybasedonbodyweightor body massindex(BMI)andevolve towards

themeasurementandclinicalassessmentofadiposity.Thequestionshould be,„„dowewanttomeasurehowobeseapersonis,ordowewanttoassess ifhe/sheisatthehighestriskofadiposity-relatedcomorbidconditionsthat canpotentiallyinterferewithourmanagement?“““***(Cornieretal.,2011).***

Howdoweexplainwhysomeobesepatientsaremetabolicallyhealthy whereasotherswiththesamelevelofobesity(expressedasBMI)haveall themetaboliccomplicationsassociatedwithobesity?Individualswith normalbodyweight,asdefinedbyBMI,arestillatriskfordevelopingthe metabolicsyndromeiftheyhaveahighbodyfatcontentorahighwaist circumference.Thisindicatesthatobesityisaheterogeneouscondition. AlthoughBMIisausefultooltodescribechangesinadiposityatthe populationlevel,itcannotdiscriminatetherisksofassociateddiseaseatthe individuallevel.Sowewillfocusinthischapterontheunderstandingofthe pathophysiologicalchangesoccurringwithobesityanditsclose relationwith adiposity***(Romeroetal.,2010).***

Table(1):ClassificationofObesityandLevelsofRisk Associatedwith IncreasingBody Mass Index (Sinha andEckmann, 2010).

Classification	BMI(kg/m²)	Risk ofHealth Problems Developing
Underweight	<18.5	Increased
Normalweight	18.5-24.9	Least
Overweight	25.0-29.9	Increased
Obese		
Class1	30.0-34.9	High
Class2	35.0-39.9	Veryhigh
Class3	40.0-49.9	Extremelyhigh
Superobese	≥50	Exceedinglyhigh

In 1947,basedonsimpleclinicalobservations,JeanVagueintroducedthe termandroidobesitytodescribethehighriskformofobesityincontrastto thegynoidobesitycarryingthelowerrisk***(Vague,1947).***Thislaunchedthe ideathatthecommoncomplicationsofobesitywererelatedmorecloselyto thedistributionof fatthanobesityper se***(Foxetal.,2007).***

In1980, BjörntorpandKissebahreportedthatthewaistto hipratio ***(WHR)***wasrelatedtoincreasedriskofcoronaryarterydisease***(CAD),***type 2diabetesmellitus***(T2DM),***andtoadiabetogenic/atherogenicmetabolicrisk profile***(Kissebah etal.,1982),(Bjorntorp,1988).***

Therelativeaccumulationofabdominalfatincreasesthewaist circumferencerelativetothehipgirth.Thisprovidednewevidencethat bodyfatdistributiondeservesmoreattentionasapredictorofcomorbidities thansimplemeasuresofexcessbodyweight.Withtheintroductionof computedtomography***(CT)***andmagneticresonanceimaging***(MRI)***, researcherswereabletomakeadistinctionbetweenthesubcutaneous adiposetissue***(SAT)***oftheabdomenwallandfatlocatedintheabdomen, whichiscalledvisceraladiposetissue***(VAT)***andincludesomental, mesenteric,andretroperitonealfat ***(Kelleyetal., 2000).***

SoDependingonfatdistribution,therearetwoformsofobesity:an androidformandagynecoidform.Theandroidformoccurswhenfat distributescentrally(liver,omentum,intraperitoneal),whereasthegynecoid forminvolvesfatdistributioninbuttocks,arms,andlegs.Theandroidform isassociatedwithahighermorbidityandmortalityrisk***(Westerly and, Dabbagh,2011).***

Methods ofAssessing BodyFat Distribution

1- *WaistCircumference*

Althoughwaistcircumference***(WC)***isaninexpensivewaytoassess centralobesitywithexcellentcorrelationwithimagingtechniquesandhigh associationwithcardio-vasculardiseaseriskandmortality,it doeshave somepracticallimitationsincludinglocationofmeasurementandcut-off values***(De Koningetal.,2007).***

Additionally,itcannotdifferentiateSATfromVAT.Thereareeight differentmeasurementlocationsthathavebeenusedanddifferentexperts recommenddifferentmeasuringpoints.TheWHOrecommendstheuseof themidpointWCmeasurement(halfwaybetweeniliaccrestandlowestrib) whereastheNationalInstitutesofHealthandtheAmerican HeartAssociationareinfavorofmeasuringWCattheiliaccrest***(Rossetal., 2008).***

2- *HipCircumference*

Althoughhipcircumference***(HC)***doesnotappeartobeasignificant predictorofall-causemortality,itisusedtocalculatethewaist/hipratio ***(WHR)(Masonetal.,2008).***Itismeasuredatthelevelofthewidest circumferenceatthebuttocksbecausewiderhipsimplyfunctionalSATand thusprovide protectionagainstcardiovasculardisease***(Snijderetal.,2004).***

3- *OtherBodyCircumferences*

Thighandcalfcircumferenceshavebeenusedtoprovideanindexof uppertolowerbody adiposity.Largerthighcircumferenceisassociatedwith

lowerriskofT2DMbothinmenandwomenwhereasthighcircumference wasnegativelyassociatedwithmortalityinmenbutnotinwomen***(Snijder etal.,2004).***

NeckcircumferenceincreasestheoddsofMetSinmenandinparticular womenandcanbeassociatedwiththeseverityofobstructivesleepapnea ***(OSA) (Preisetal.,2010).***

4- ***Rati os***

Variousratioscanbecomputedandhavebeenusedtopredicttheriskof metabolicdisordersinobesity.ThemostcommonareWHR,waisttoheight ratio(WHtR)andwaisttothighratio.StudieshavefoundthatBMI,WCand WHRarestronglyandindependentlyrelatedtotype2diabetesmellitus (T2DM) inbothmenandwomen***(Meisingeretal.,2006).***

Tayloretal.wereabletodemonstratethatBMI,WHR,WHtRandWC correlatewithCVDriskfactors,withHCbeinglessstrongly associatedwith triglyceride concentrationsandinsulinemia***(Tayloretal.,2010).***

WHR,WHtR andWCwere superior inpredictingtheincidence of CADin white middle-agedwomen***(Page etal.,2009).***

5- ***CTandMRI***

A***CT***scancancomputeareas(fromasingleslice)andevenvolumes (fromrepeated10-cmintervalslices)ofselectedtissuesinthebody,in particular adiposetissue depots.VATandSATcontent of the bodyare