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Updates on selection criteria for ambulatory surgery

Filipa de Abreu Maia

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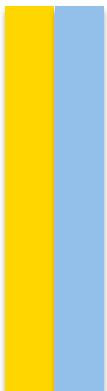

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Dissertação de candidatura ao grau de Mestre em Medicina, submetida ao Instituto de Ciências Biomédicas Abel Salazar – Universidade do Porto

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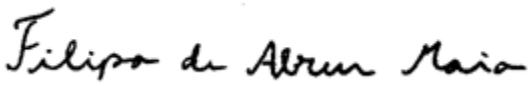

Orientador: Humberto José Silva Machado

Porto, Junho de 2022

DEDICATION | DEDICATÓRIA

Aos meus pais, por todo o seu apoio incondicional e sempre me incentivarem a alcançar os meus sonhos.

À minha irmã, que me inspira todos os dias a dar o melhor de mim e a quem espero conseguir orgulhar.

À minha avó, pela sua perpétua bondade e carinho.

Aos restantes membros da minha família, pelo encorajamento que me deram.

Aos meus amigos, que me acompanharam e motivaram ao longo deste árduo percurso.

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Ao Professor Doutor Humberto Machado, por ter aceitado ser o meu orientador neste trabalho e por toda a disponibilidade e atenção dedicada.

RESUMO

Introdução: A cirurgia de ambulatório consiste na intervenção cirúrgica eletiva onde os doentes são admitidos, operados e têm alta no mesmo dia útil. Caso seja necessário o doente permanecer no hospital durante a noite, é referido como "cirurgia de ambulatório com pernoita". Os avanços das técnicas cirúrgicas e desenvolvimento de novos fármacos anestésicos conduziram a uma grande expansão deste regime cirúrgico, evoluindo ao longo do tempo desde pequenas cirurgias em doentes saudáveis para intervenções mais complexas em doentes com diferentes comorbilidades médicas. O sucesso e a segurança da cirurgia de ambulatório dependem fortemente dos seus critérios de seleção, que podem ser divididos em fatores médicos, cirúrgicos e logísticos.

Objetivo: Com esta revisão pretende-se avaliar de que forma os fatores médicos, complexidade cirúrgica e aspetos logísticos podem comprometer a elegibilidade para a cirurgia de ambulatório.

Métodos: Realizou-se uma pesquisa e seleção de artigos científicos originais redigidos em inglês e português e publicados entre 2016 e 2021, recorrendo aos motores de pesquisa *PubMed* e Google Académico. Foram usados termos *MeSH* e seus livres sinónimos. Apenas foram selecionados os artigos relevantes para o tópico da revisão. Informação das publicações listadas nas referências bibliográficas dos artigos selecionados foi examinada detalhadamente quando pertinente.

Resultados e discussão: Trinta e um estudos foram obtidos. Idade, fragilidade, classificação ASAPS, apneia obstrutiva do sono e obesidade são fatores que devem ser tidos em conta na avaliação pré-operatória dos doentes. Várias cirurgias gastrointestinais e ginecológicas minimamente invasivas são viáveis em regime de ambulatório. São necessários mais estudos para determinar a segurança da alta no próprio dia após o tratamento endovascular de aneurismas da aorta abdominal. Existe a possibilidade de ambulatorização de cirurgias de emergência, como apendicectomias. Razões logísticas constituem muitas vezes um impedimento à alta no próprio dia, contudo grande parte são modificáveis.

Conclusão: Em geral, razões médicas, complexidade cirúrgica e fatores logísticos raramente impedem a cirurgia de ambulatório, quando são seguidas as recomendações adequadas. A seleção adequada dos doentes e gestão perioperatória e *follow-up* meticulosos são essenciais.

PALAVRAS-CHAVE

"Cirurgia de Ambulatório", "Procedimentos Cirúrgicos Ambulatórios", "Seleção de Doentes", "Critérios de Seleção"

ABSTRACT

Introduction: Ambulatory surgery is the elective surgical intervention where patients are admitted, operated on and discharged during the time frame of one working day. In cases where patients stay overnight, it can be referred to as "ambulatory surgery with extended recovery". Advancements in surgical techniques and development of new anesthetic drugs led to a great expansion of this surgical regime, progressing over time from minor surgeries on fit patients to more complex interventions on patients with different medical comorbidities. The success and safety of ambulatory surgery greatly depends upon its selection criteria, which can be divided into medical, surgical and logistical factors.

Objective: The aim of this review is to evaluate the ways in which medical factors, surgical complexity and logistical aspects can compromise the eligibility for ambulatory surgery.

Methods: A review and selection of original scientific publications written in English and Portuguese, published between 2016 and 2021 and indexed in the search engines PubMed and Google Scholar was performed. MeSH terms and their free synonyms were used. Only articles relevant to the topic of the review were selected. Information from articles enlisted in the bibliographic references of the selected publications was examined in detail when relevant.

Results and discussion: Thirty one studies were obtained. Age, frailty, ASA PS class, OSA status and obesity are factors that should be taken into account when evaluating patients prior to surgery. Several minimally invasive gastrointestinal and gynecologic surgeries are feasible in the ambulatory setting. More research is needed to determine the safety of same-day discharge after EVAR. Emergency surgeries such as appendectomy can be included in the ambulatory pathway. Logistical reasons often preclude patients from undergoing same-day discharge, but are largely modifiable.

Conclusion: Overall, medical reasons, surgical complexity and logistical factors rarely preclude patients from day surgery, when the proper recommendations are followed. Adequate patient selection and meticulous perioperative management and follow-up are paramount.

KEYWORDS

"Outpatient Surgery", "Ambulatory Surgery", "Ambulatory Surgical Procedures", "Day Surgery", "Patient Selection", "Selection Criteria"

LIST OF ABBREVIATIONS

ASA PS	American Society of Anesthesiologists Physical Status
ASC	Ambulatory surgery center
BMI	Body mass index
CBC	Complete blood count
CRP	C-reactive protein
EBL	Estimated blood loss
ERAS	Enhanced recovery after surgery
EVAR	Endovascular aneurysm repair
IAAS	International Association for Ambulatory Surgery
ICU	Intensive care unit
ITT	Intention-to-treat
LAM	Laparoscopic-assisted myomectomy
LOS	Length of stay
mFI	Modified frailty index
NSQIP	National Surgical Quality Improvement Program
OHNS	Otolaryngology - Head and Neck Surgery
OSA	Obstructive sleep apnea
PACU	Post-anesthesia care unit
PONV	Postoperative nausea and vomiting
RAI	Risk Analysis Index
RR	Relative risk
SCD	Sequential compression devices
TED	Thromboembolic disease
UAA	Uncomplicated acute appendicitis
VTE	Venous thromboembolism
WHO	World Health Organization

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

The term "ambulatory surgery", also known as "day surgery" and "outpatient surgery", is defined by the International Association for Ambulatory Surgery (IAAS) in its purest sense ("True Ambulatory Surgery") as the elective surgical intervention "where patients are admitted, operated on and discharged during the time frame of one working day (6 to 8 hours)", and there is no overnight stay.[1] However, definitions can vary between countries, with 23-hour observation sometimes falling into this category and other times being regarded as inpatient treatment,[2–4] and thus it is important to clarify these terms when employed in research.

In cases where overnight stay is necessary, the IAAS considers it as "Ambulatory Surgery with Extended Recovery", "where patients are admitted, operated on and stay for one night postoperatively in a hospital facility (overall stay up to 23 hours)".[1]

In Portugal, the Order No. 163/2013 of April defines ambulatory surgery as all the planned surgical intervention undertaken under general, locoregional or local anesthesia, within proper installations, with safety and according to the current *leges artis*, where admission and discharge of the patient happen under 24 hours.[5] Therefore, the possibility of an overnight stay is implicitly contemplated.

Ambulatory surgery can be carried out in free-standing or hospital-based facilities, whereas office-based surgery is, according to IAAS, an "operation or procedure completed in a medical practitioner's professional premises", and should be considered as a distinct entity.[5]

The origins of modern day surgery can be traced back to the beginning of the 20th century, concerning the accomplishments of Scottish pediatric surgeon James Nicoll at the Sick Children's Hospital and Dispensary in Glasgow, Scotland. His work was published in the British Medical Journal in 1909, describing the general success of almost 9,000 pediatric day-case procedures.[7] Nevertheless, it was only from the 70s onwards that the advancements in surgical techniques and development of new anesthetic drugs led to a great expansion of this surgical regime, progressing over time from minor surgeries on fit patients to more complex interventions on patients with different medical comorbidities.[4,8] Several studies were then published regarding the security, quality, financial benefits and organization of ambulatory surgery, propelling its rapid implementation worldwide. As a result, it nowadays accounts for more than half of all elective surgical procedures in many countries.[8]

The advantages of ambulatory surgery are numerous, bringing benefits for the patient, hospital/ambulatory surgical facility and healthcare funder. For patients, quality is improved by decreasing postoperative complication rates (such as infection and thromboembolism), allowing early mobilization and recovery at home (contributing to a speedier recovery and resumption of everyday activities, including work), increasing surgical accessibility, lowering patients' stress levels and diminishing disorientation, particularly in the elderly. Elective day surgery is better managed by hospitals and ambulatory surgery centers since last minute cancellations are residual. Also, more inpatient beds become available for major surgery patients and surgical waiting lists are generally reduced. Innovations in the medical field, increased patient demand and ageing of the population burden healthcare budgets, and day surgery can be an effective way of rationalizing costs while maintaining quality and safety.[7,9] Nonetheless, it's crucial to realize that overall costs will only decrease if a reduction in inpatient activity actually takes place, which must be proportionate to day surgery increase.[10] Some concern over this process being merely a way of shifting expenditures from hospitals to community care has been raised, but careful planning and organization prevents that. Moreover, there has been apprehension about setting additional costs onto the patient and caregiver. Faster recovery and early return to work can in fact reduce spending for the patient, however some expenses can indeed arise such as transport to the ambulatory unit and acquisition of medication for the recovery period. In addition, ambulatory surgery usually requires a caregiver to remain with the patient for a minimum of 24 hours postoperatively, which can result in missing some work days.[9,10]

In view of its numerous benefits, the general mindset has changed from "what surgeries can be done as ambulatory procedures?" to "what surgical interventions shouldn't be done in an ambulatory regime?", treating day surgery as the norm and requiring justification for hospital admission.[11] It should be practiced within proper facilities, observing safety measures and according to the current *leges artis*.[12] Since surgical centers have differences amongst themselves, a procedure deemed safe and feasible in a particular unit may not be so in another. Therefore, before even considering patient selection for day surgery and in order to determine what procedures can be done where, it's important to be mindful of the particular limitations of each center and the capacity of the associated hospital to respond in case of complications. Hospital admission of an ambulatory surgery patient implies more costs and represents a failure of this surgical modality.[11]

The success and safety of ambulatory surgery greatly depends upon its selection criteria, which can be divided into medical, surgical and logistical factors. Encouraging study results and progress in the surgical and anesthetic fields have made it so that very few absolute

contraindications to day surgery currently exist, and certain limitations previously in place are no longer considered obligatory.[4] Guidelines regarding eligibility for day surgery that are based on patients' functional limitation and physiological condition instead of hard-set uncorroborated cut-offs have greater legitimacy and endurance, and a question that can guide the verdict is whether or not the management or outcome of the procedure can be ameliorated by hospitalization.[7]

It should also be mentioned that minimizing postoperative complications and assisting individuals with the recovery period, including pain control and diligent follow-up care, is a crucial factor in the rehabilitation of the patient and the overall success of day surgery.[10]

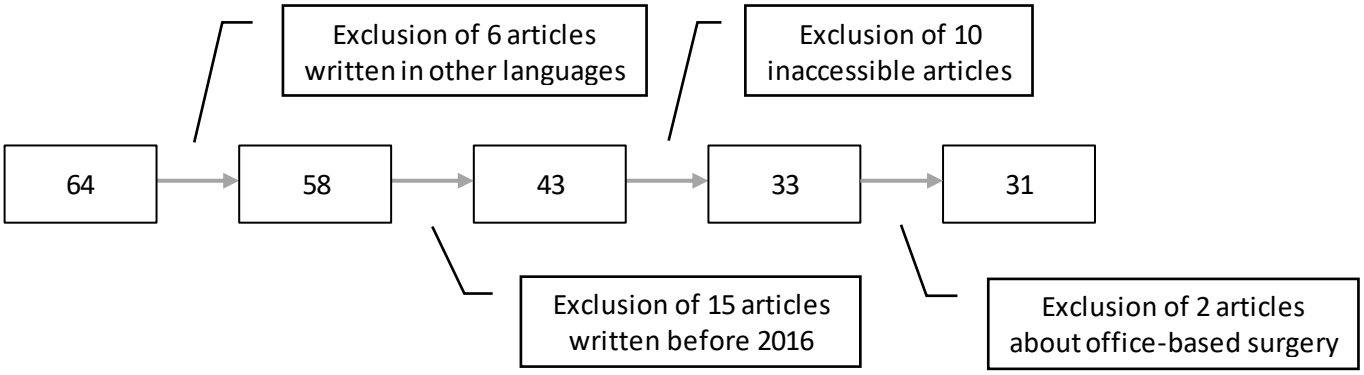
OBJECTIVE

The aim of this review is to evaluate the ways in which medical factors, surgical complexity and logistical aspects can compromise the eligibility for ambulatory surgery.

METHODS

A review and selection of original scientific publications written in English and Portuguese and indexed in the search engines PubMed and Google Scholar was performed. The publication date range for the search was between 2016 and 2021. The keywords employed in the search were the MeSH of Index Medicus terms “Outpatient Surgery”, “Ambulatory Surgery”, “Ambulatory Surgical Procedures”, “Day Surgery”, “Patient Selection”, “Selection Criteria” and their free synonyms, in different combinations. The selection of articles was initially based on a review of titles, authors, dates of publication, scientific journals and abstracts, and subsequently on a full-text reading. Inclusion criteria required studies on ambulatory surgical procedures, performed in free-standing or hospital-based facilities, and referencing its selection criteria. Exclusion criteria comprised articles written in other languages besides English and Portuguese, publication dates prior to 2016 or later than 2021, titles and abstracts unrelated to the intended topic (e.g. office-based surgery) and inaccessibility to the publication. Information from articles enlisted in the bibliographic references of the selected publications was examined in detail when relevant.

Flowchart of article selection



RESULTS

The search method yielded 31 eligible articles. The main results of each article are presented herein, categorized under three headings: medical, surgical and logistical factors.

Medical factors

Elderly

A retrospective study evaluated the parameters that influence the decision to discharge patients up to 24 hours after laparoscopic cholecystectomy with a sample of 207 patients. Results showed that 34 out of 154 patients aged < 75 years (21.7%) and 11 out of 53 patients aged > 75 (20.7%) were discharge within this time frame.[13]

On 120 "high acuity" cases, Billing et al. evaluated the safety and efficacy of ambulatory sleeve gastrectomy, and reported that the “high acuity patient”, which includes patients with ≥ 65 years of age, can undergo day surgery without inferior outcomes in a specialized free-standing ambulatory surgery center (ASC).[14]

Wu et al. reported that within an obstructive sleep apnea (OSA) population of 80 individuals, admitted patients were significantly older than non-admitted patients following ambulatory Otolaryngology - Head and Neck Surgery (OHNS), with a mean difference of 8.9 years.[15]

A retrospective cohort analysis of close to 390,000 patients described the main clinical outcomes in older individuals submitted to ambulatory surgical procedures. Specifically, admission on the same day, and complication, readmission and mortality rates within 30 days of surgery for 3 different age groups (< 65 years as the reference non-geriatric cohort, 65-79 years and ≥ 80 years old) were analyzed in patients who were subjected to one of the 10 most often performed ambulatory surgeries listed in the study, under general anesthesia. It reported that patients aged ≥ 80 years had at least a two-fold increased likelihood of hospital admissions on the same day of the procedure, 30-day composite postoperative adverse events and 30-day readmission, when compared with the non-geriatric cohort. Moreover, they also had a five-fold increase in the rate of mortality within 30 days of surgery. Older patients had a higher probability of having cardiovascular and pulmonary comorbidities with decreased functional status, however the link between older age and outcomes remained after controlling for these confounding factors. The presence of medical conditions like chronic obstructive pulmonary disease, cardiovascular disease, current smoking history, preoperative steroid use, diabetes mellitus, hypertension, and preoperative bleeding disorder contributes to higher risk of adverse incidents in older patients. On a

multivariable regression examination for each surgical intervention, those with ≥ 80 years of age showed increased odds of admission on the same day of the operation for umbilical hernia repair, inguinal hernia repair, laparoscopic cholecystectomy, laparoscopic inguinal hernia repair, partial mastectomy, lumbar laminotomy and laparoscopic removal of adnexal structures.[16]

Frailty

Seib et al. conducted a retrospective cohort study including 140,828 patients with ages > 40 years old, to determine the association of frailty with perioperative morbidity in individuals submitted to ambulatory general surgeries (parathyroid, thyroid, hernia or breast operations). The National Surgical Quality Improvement Program (NSQIP) modified frailty index (mFI) was used to assess patient's frailty, which is a validated measure established from 11 NSQIP variables and adapted from the Canadian Study of Health and Aging Frailty Index. A low mFI score is ≤ 0.18 (corresponds to zero to one frailty traits), intermediate mFI score is between 0.18-0.35 (corresponds to two to three frailty features) and lastly high mFI score is ≥ 0.36 (corresponds to four or more frailty features). Complication rates were overall low and mortality rate within 30 days of surgery was uncommon. Amongst the most frequent comorbidities that contribute to frailty in intermediate and high mFI score groups were diabetes, hypertension and coronary artery disease. Results showed that any perioperative complication developed in 1.7% of patients and serious complications were reported in 0.7%. Most frequently observed complications were superficial incisional, deep incisional or organ or space surgical site infections, and subsequently urinary tract infections, sepsis and pulmonary events. Higher mFI scores were related to a statistically relevant increase in the incidence of any complication (1.5% for low mFI scores versus 5.8% for high mFI scores). The same result was observed in serious complications, where the incidence in patients with low mFI scores was 0.6% compared to 3.0% in patients with high mFI scores. Finally, 30-day mortality also followed the same pattern, where the group with low mFI scores had a mortality incidence of 0.04% and the group with high mFI scores the incidence was 0.3%. Furthermore, a higher percentage of LOS longer than 1 day was noticed in intermediate mFI scores (3.2%) and high mFI scores (5.4%), when comparing to low mFI scores (1.9%). In the multivariable logistic regression models, intermediate mFI scores demonstrated adjusted odds ratios of 1.70 for any complication and 2.00 for serious ones, and high mFI scores showed adjusted odds ratios of 3.35 for any complication and 3.95 for serious complications. Ages between 80-89 years or ≥ 90 years also showed higher probability of developing a serious complications. Local anesthesia with monitored anesthesia care was found to be the sole modifiable covariate that was linked with lower risk of

developing a serious complication in the 30-day postoperative period (adjusted odds ratio of 0.66).[17]

Rothenberg et al. investigated the connection between frailty and unplanned readmissions within 30 days following programmed ambulatory surgery and also the potential influence of surgical complications on this association. The Risk Analysis Index (RAI) was used to assess frailty, based on the NSQIP variables sex, age, weight loss, dyspnea, disseminated cancer, congestive heart failure, renal failure and the transfer, functional and cognitive status. A RAI score of ≥ 30 was used to define frailty. The cohort was stratified into length of stay (LOS) = 0 (discharge within 24 hours of surgery) and LOS ≥ 1, with no information regarding the causes for observation or admission after ambulatory surgery. The age of frail individuals was considerably higher than nonfrail patients (LOS = 0: mean age, 64.9 vs 35.0 years). Within those who had a LOS = 0 days, 2.5% patients were classified as frail. Unplanned readmissions occurred in 2.0% of patients with LOS = 0. Frailty was linked with increased 30-day unplanned readmissions compared to nonfrailty, irrespective of frail patients having no complications, a minor one or a major one (LOS = 0, 8.3% vs 1.9%). Postoperative complications were overall infrequent (LOS = 0, 2.6%), but more common amongst frail than nonfrail individuals (LOS = 0, 6.9% vs 2.5%). Frailty doubled the probability of unexpected readmission in a multivariable examination (LOS = 0: adjusted RR of 2.1). Mediation analysis showed that the occurrence of complications only partially mediated the relationship between frailty and readmissions (LOS = 0, 22.8%).[18]

Table I – Variables relating to frailty traits that are included in the 11-variable NSQIP mFI.[17]

	Variables
1	History of diabetes
2	Impaired functional status
3	History of chronic obstructive pulmonary disease or pneumonia
4	History of congestive heart failure
5	History of myocardial infarction within 6 months
6	History of percutaneous coronary intervention
7	Cardiac surgery or angina
8	Receipt of hypertensive medications
9	Peripheral vascular disease or rest pain
10	Impaired sensorium
11	History of transient ischemic attack or cerebrovascular accident with persistent residual deficit

Table II – RAI Score Components Mapped to NSQIP.[18]

Variable	RAI		NSQIP Variable
Male Sex	3		SEX
Age*Cancer	no cancer	cancer	
Age			
≤19	0	28	
20-24	1	29	
25-29	4	29	
30-34	6	30	
35-39	8	30	
40-44	10	31	
45-49	12	31	AGE
50-54	14	32	DISCANCR
55-59	16	32	
60-64	18	33	
65-69	20	34	
70-74	22	34	
75-79	24	35	
80-84	26	35	
85-89	28	36	
90+	30	36	
Weight Loss	8		WTLOSS
Renal Failure	8		RENAFAIL; DIALYSIS
Congestive Heart Failure	5		HXCHF
Shortness of Breath	3		DYSPNEA
Residence other than Ind. Living	1		TRANST
Activities of Daily Living*Cog	no cognitive	cognitive	
Totally dependent	14	16	FNSTATUS2
Partially dependent	7	11	IMPSENS; COMA; CVA
Independent	0	5	
Total RAI (range)	**0**	**81**	

ASA Physical Status

A 2021 observational study with a sample of over two million cases endeavored to determine if the American Society of Anesthesiologists Physical Status (ASA PS) score was an independent risk factor for morbidity and mortality in the setting of day surgery, as well as how that relation could be modified depending on the specific intervention and anesthetic method. The adjusted odds ratio of complications, readmission and mortality showed a stepwise independent relation with the ASA score, through multiple surgical subspecialties and anesthesia techniques, with higher scores being associated with increased risks. Moreover, the risk of mortality after ambulatory surgery was 89 times greater for ASA PS IV than ASA PS I patients.[19]

Wu et al. observed that ASA PS scores were significantly greater in admitted OSA patients in comparison to those non-admitted after ambulatory OHNS.[15]

Table V – ASA PS Classification.[20]

ASA PS Classification	**Definition**
ASA I	A normal healthy patient
ASA II	A patient with mild systemic disease
ASA III	A patient with severe systemic disease
ASA IV	A patient with severe systemic disease that is a constant threat to life
ASA V	A moribund patient who is not expected to survive without the operation
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes

Obstructive sleep apnea

A retrospective study published in 2019 analyzed the association between previous diagnosis or STOP-Bang risk of OSA and the safety and outcomes for patients submitted to different cancer surgeries in a free-standing ASC. The sample included a total of 5,721 patients, of whom 526 had a moderate or high risk for OSA or had been previously diagnosed with OSA. The study included true ambulatory surgeries as well as more complex ambulatory surgeries with extended recovery, where patients stayed overnight. In the multivariate analysis, the risk of OSA did not show a statistically relevant link to the length of stay, readmission, transfers to a hospital and visits to the urgent care center. Although a higher proportion of postprocedural respiratory adverse incidents was observed

in diagnosed or high-risk OSA individuals than moderate-risk OSA cases, these did not defer discharge or increment transfers after surgery.[21]

Another recent retrospective study evaluated if the rate of hospital readmission and postoperative complications differed between ambulatory and inpatient airway surgery for OSA. It concluded that for similar airway surgery procedures on patients with very similar characteristics the probability of postoperative complications and hospital readmissions in the 30 days after surgery did not significantly vary in the ambulatory versus inpatient setting.[22]

Wu et al. evaluated the percentage and reasons for admitting OSA patients after being submitted to day-case OHNS. They found an admission rate of 47.5%, therefore over half of these patients did not need to be admitted, regardless of indication for surgery and type of surgical procedure. No intra- or post-operative adverse events occurred, apart from one patient who experienced hypercapnic respiratory failure as well as serotonin syndrome following surgery and required relocation to the intensive care unit (ICU). As such, the main reason for admitting a vast majority of patients (97%) was overnight monitoring and they had an average LOS of 1 day with no complications, except for the one case that needed ICU admission, whose LOS lasted 4 days. When compared to non-admitted OSA patients, those who were admitted were older and had a greater ASA score.[15]

Table III – STOP-Bang Questionnaire.[23]

	Yes	No
S = Snoring. Do you snore loudly (louder than talking or loud enough to be heard through closed doors)?		
T = Tiredness. Do you often feel tired, fatigued, or sleepy during daytime?		
O = Observed apnea. Has anyone observed you stop breathing during your sleep?		
P = Pressure. Do you have or are you being treated for high blood pressure?		
B = BMI > 35 kg/m^2?		
A = Age > 50 years?		
N = Neck circumference > 40 cm?		
G = Gender male?		
Low risk of OSA: answering yes to less than three items **High risk of OSA**: answering yes to three or more items **High probability of moderate-to-severe OSA**: answering yes to five of more items		

Obesity

Gregori et al. compared the outcomes of day-case laparoscopic cholecystectomy in obese (body mass index (BMI) ≥ 30 kg/m^2) and non-obese (BMI < 30 kg/m^2) individuals and found that morbidity, hospital admissions and readmissions were similar between the two groups, demonstrating its safety and feasibility in the obese population.[24]

Billing et al. showed that "high acuity" criteria such as BMI, as well as age and prior bariatric surgery, were not linked with poorer outcomes in a specialized ASC. It concluded that skilled surgeons, adequate protocols and a consistent operative team allowed for sleeve gastrectomy to be performed without an increase in complications in a free-standing ASC on select "high acuity" individuals, which included males with a BMI ≥ 55 kg/m^2 and females with a BMI ≥ 60 kg/m^2.[14]

Warrender et al. found that the rates of minor adverse events in a high-BMI cohort (> 40 kg/m^2) submitted to hand and elbow surgery performed at an ASC were similar compared to a normal-BMI group. Results showed that two patients with high BMI experienced desaturation episodes in the recovery room and in the normal-BMI cohort none did, which likely reflects the higher prevalence of OSA in patients with greater BMI. However, both episodes did not cause major complications or require airway management, and the patients were discharged. In the high–BMI cohort, one individual developed hypotension in the post-anesthesia care unit (PACU) and was transferred to the emergency department and admitted overnight for monitoring, however was discharged the next morning after an uneventful course. The in-room anesthesia times in the preoperative and postoperative period were comparable between the two groups, as well as the amount of time patients stayed in the recovery room. In addition, four high-BMI patients underwent monitored anesthetic care to general anesthesia conversion compared to two normal-BMI patients, being unclear whether because patients could not tolerate the procedure or the anesthesiologist thought it best to secure a questionable airway.[25]

Obese patients' suitability for cancer surgery in a true ambulatory surgery or ambulatory surgery with extended recovery environment was investigated in an observational study utilizing prospectively obtained data. Instead of using BMI categories, a full range of BMI values was evaluated. Results revealed that higher BMI was not linked to a longer length of stay or with increased likelihood of urgent care center visits or 30-day readmissions. Greater BMI was related with higher rate of transfer to a main hospital, but the rate difference was minor and not clinically relevant. BMI had a statistically but not clinically significant effect on operating time.[26]

Another study, based on a database with almost 200,000 patients, found that BMI ≥ 40 and < 50 kg/m^2 was not related with an elevated risk of unplanned hospital admission following day-case laparoscopic cholecystectomy, although a BMI ≥ 50 kg/m^2 was associated with a modest increase of 10%. In addition, BMI was not linked to an increased risk of postoperative complications on the same day of surgery.[27]

After day-case eligible joint arthroscopy of the knee, hip, or shoulder, a retrospective study looked at the relationship between BMI and complications on the same day of surgery, hospital admission and 30-day hospital readmission. Results showed that only a BMI ≥ 50 kg/m^2 was associated with higher odds of hospital admission, even when their medical comorbidities were optimized, after controlling for several medical conditions and demographic information. No differences were observed in same-day postprocedural adverse events or hospital readmission in the 30 days following surgery.[28]

Gabriel et al. conducted a retrospective multi-institutional study with 12,287 adult patients submitted to tonsillectomy on an ambulatory basis. They reported that those with a BMI ≥ 40 kg/m^2 had a greater relative risk of same-day hospital admission by two-fold compared to those with a BMI < 40 kg/m^2. The obesity class 3 (BMI ≥ 40 kg/m^2) cohort was divided in three BMI ranges and compared to a composite reference group of obesity class 1 and 2, since it represents a population who is usually accepted for day surgery. From subsequent analysis of these ranges, it was found that BMI ≥ 40 and < 50 kg/m^2 had a 1.3 times greater probability of hospital admission, BMI ≥ 50 and < 60 kg/m^2 had a 2 times increased probability and BMI ≥ 60 kg/m^2 showed no statistically significant increase, possibly as a result of the sample size being smaller. Furthermore, in individuals within greater BMI intervals an elevated risk for 30-day readmission was not observed. In addition, it is known that obesity significantly affects the occurrence of post-tonsillectomy hemorrhage, and the most frequent cause for 30-day readmission in this study was postprocedural bleeding.[29]

Table IV – Body weight classification according to BMI, adapted from WHO.[30]

Body weight classification	**BMI (kg/m^2)**
Underweight	≤ 18.5
Normal weight	18.5 – 24.9
Pre-obesity	25.0 – 29.9
Obesity class I	30.0 – 34.9
Obesity class II	35.0 – 39.9
Obesity class III	≥ 40

Surgical factors

General surgery

- Appendectomy

Aubry et al. conducted a prospective observational research with an intention-to-treat (ITT) analysis in 2017, in order to assess the feasibility and clinical outcomes of individuals with uncomplicated acute appendicitis (UAA) operated within a 24-h emergency outpatient surgery unit. The preoperative eligibility criteria for outpatient appendectomy (defined as LOS < 24 h) were: diagnosis of UAA, absence of comorbidities, no mental or physical condition precluding taking part in the study, exclusion of pregnancy, age > 15 years old, escort available for the time of discharge and residence situated within 1 hour from the hospital. Of the 194 consecutive patients with acute appendicitis screened, 150 (77%) were diagnosed with UAA and 102 (68%) were eligible for ambulatory surgery, with or without overnight stay. Almost two-thirds (63%) of the eligible patients presented to the emergency department between 12 am and midnight. A laparoscopic approach was employed in 101 (99%) of the eligible patients, and an open surgery was performed in the remaining cases. Thirteen (13%) eligible patients were excluded from the ambulatory pathway, seven for intraoperative contraindications (complicated appendicitis in five cases, anaphylactic reaction in one case and severe hypoxemia during the laparoscopic procedure in one case) and six for postoperative contraindications (absence of accompanying adult in three cases, acute urinary retention in two cases and pain requiring parenteral analgesics in one case). Therefore, ambulatory appendectomy was conducted in 89 patients (59% of the ITT population and 87% of the eligible population). The median time between diagnosis and surgery was 2h34, and the time between admission to the PACU and discharge from the hospital was 9h42. From admission to discharge, the median LOS was 13 hours (range 6-23), with 44 (43%) eligible individuals having a LOS < 12 h. Median LOS was significantly shorter when surgery occurred in the daytime (between 6 am and 6 pm) compared to overnight (10.5 h, range 6–23 vs 14 h, range 9–23). Median LOS was particularly longer when surgeries were performed in the time period of 6 pm to midnight (15 h, range 9–23). Six (6%) eligible patients experienced 30-day postoperative complications (two hematoma, one orchiepididymitis, one peritoneal infiltration, one colitis and one pelvic abscess). Of these, two (2%) required rehospitalization.[31]

A retrospective study by Gignoux et al. evaluated the outcomes of complicated and uncomplicated appendectomies carried out on a true ambulatory (same-day discharge) and conventional (overnight stay) basis and aimed to identify factors linked with unanticipated reconsultations or rehospitalizations. By default, every patient diagnosed with uncomplicated or

complicated acute appendicitis was considered eligible for ambulatory surgery, unless the ensuing preoperative contraindications were present: (i) operation cannot be carried out before 5 pm and cannot be deferred to the following day; (ii) severe comorbidities which require monitoring; (iii) home-hospital journey > 1 h; and/or (iv) patient lives alone. Depending on the expertise of the emergency team, there was a reversion to inpatient appendectomy if at least one of the subsequent peri- and post-operative contraindications developed: (v) abscess or generalized peritonitis necessitating intravenous antibiotics; (vi) anaphylaxis; (vii) oral analgesics ineffective in treating pain; (viii) fever; or (ix) vomiting. Initially, of the 185 laparoscopic appendectomies cases, 117 (63.2%) were suitable to undergo AS. However, eight experienced peri- or post-operative contraindications (three severe infection, two generalized peritonitis, two excessive pain and one anaphylaxis), therefore 109 (58.9%) cases were in fact operated on a true ambulatory basis. Ambulatory surgery cases were significantly younger and had smaller appendix diameters, less appendix perforations and shorter operative times. Within the sample of 185 cases, 32 (17.3%) patients experienced postoperative complications, such as uncontrollable pain or fever in 13 (7.0%) patients, wound infections in eight (4.3%), abdominal abscess in five (2.7%), ileus in two (1.1%), phlegmon in one (0.5%), hematoma in one (0.5%), liver abscess in one (0.5%) and acute urinary retention in one (0.5%). Of the 32 patients who developed complications, a total of 12 were rehospitalized, six for pain or fever without an abscess, three for abdominal abscess, one for hepatic abscess, one for ileus and one for phlegmon. Same-day discharge patients had a smaller incidence of adverse events compared to admitted patients (11.9% vs 25.0%). The rates of unplanned reconsultations, rehospitalizations and reinterventions were similar between ambulatory and conventional cases. There was no significant association between unexpected reconsultations and any pre- or peri-operative factors, however unexpected rehospitalizations were four times more frequent in the presence of appendicolith in uni- and multi-variable regressions.[32]

- Colectomy

Chasserant et al. conducted a prospective analysis to assess if an optimized management approach could allow ambulatory left colectomy in a broader patient population. Inclusion criteria included colonic lesion situated in the sigmoid or upper rectum superior to the pelvic peritoneal reflection; no second colonic or rectal lesion; pathologic diagnosis of colon malignancy, polyp with or without malignant degeneration or sigmoid diverticulitis; moderate and/or controlled medical conditions; no history of multiple laparotomies; understanding and acceptance of the anticipated course of the ambulatory modality; and not living by oneself or in poor psycho-social conditions.

Exclusion criteria included more than one colonic or rectal lesion; existence of anemia preoperatively; therapeutic anticoagulation; anti-platelet therapy that cannot be discontinued for at least 72 hours; severe medical conditions; history of multiple laparotomies; patient refusal; unable to comprehend the proposed care plan; or psycho-social isolation. Out of 56 consecutive patients submitted to left colectomy, 47 fulfilled the eligibility requirements. Seven patients declined the ambulatory management, therefore 40 patients were enrolled in the study. The median age of these patients was 56 years (range 30-76), median BMI was 26 (range 20-32) and 8 patients were ASA class I, 24 ASA class II and 8 ASA class III. Cancer was the diagnostic indication for the operation in six individuals, whereas diverticulitis was the reason for surgery in 34 patients. Additional surgical procedures were conducted in seven patients (bladder dome resection for oncologic invasion, left oophorectomy, removal of an umbilical mesh, umbilical hernia repair, left salpingectomy and appendectomy concomitant with drainage of a peri-sigmoid abscess). The median operative time was of 78 minutes (range 54-147). They were all discharged on the same evening of surgery apart from one patient who did not have an accompanying adult at home, despite what was initially planned. In all instances, a complete blood count (CBC) was obtained six hours after the procedure, which revealed that hemoglobin values were stable relative to preoperative levels (Hb decrease < 1g/dL). Gastrointestinal motility resumed on D1 for the majority of patients. After discharge, all patients were surveilled in their residence by visiting nurses (two times a day up to D4 and once a day from D5 to D10) and underwent laboratory testing including CBC and C-reactive protein (CRP) (on D1, D3 and D5). In addition, they had follow-up visits with the surgeon on postoperative days 10 and 21. Two patients required follow-up visits before D10 due to abdominal pain, both were submitted to a CT scan and laboratory testing with normal results and the following course was uneventful. No rehospitalization was reported. These follow-up visits confirmed the uncomplicated postoperative course of these patients, with the exception of one case of surgical site infection that necessitated drainage, who was the same patient who underwent evacuation of a peri-sigmoid abscess during surgery.[33]

In 2019, Gignoux et al. prospectively analyzed the short-term outcomes of selected successive individuals submitted to day-case laparoscopic colectomy at two institutions. Patients had to meet rigorous criteria in order to be selected for day surgery. Inclusion criteria were age > 18 years; ASA grade ≤ III; requiring programmed laparoscopic colectomy; understanding the intervention and the enhanced recovery protocol; adequate social conditions; wanting day surgery management; and providing written informed consent. Exclusion criteria were history of midline laparotomy; large T4 tumors; multiple lesions in the colon; low rectal resection; history of perforated sigmoid diverticulitis; planned stoma; emergency surgery; severe denutrition; insulin-

dependent diabetes; curative anticoagulant treatment; nervous depression; or poor social conditions (lack of accompanying adult or living in geographically isolated or hostile location). The 157 consecutive patients that underwent ambulatory surgery had a median age of 61 years (25-82). Within the same time-frame, 357 individuals were submitted to colectomy in a conventional hospital environment with admission for 1 or more nights, and therefore the day surgery rate was 30.5%. The most common indication for surgery was sigmoid diverticulitis and the most frequent intervention was left colectomy. Every patient followed the enhanced recovery protocol with early feeding and mobilization. Median operative time was 95 minutes (range 45-232) and median LOS was 10 h (range 7-14.7). The admission rate was 7.0%, since 11 patients had to be admitted overnight mainly owing to operative, medical and social motives. Their outcomes were unremarkable with a median LOS of 3.1 days (range 1-14). Postoperative follow-up included homecare nurse visits (twice daily up to D5 and once daily in the following 5 days) and laboratory testing including CBC and CRP (on D1, D3 and D7), with the aim of rapidly detecting any complication, particularly anastomotic leakage. In addition, patients attended a consultation approximately 1 month after surgery. Thirty patients (20.5%) required an unscheduled consultation. Postoperative CRP protein level > 135 mg/L was detected in 16 individuals, resulting in an abdominopelvic CT scan being systematically carried out, which was abnormal for 12 patients. In total, nine patients (6.1%) needed readmission, of whom 6 (3.8%) needed reoperations (three cases for anastomotic leakage, two cases for small bowel obstruction and one case for omentum necrosis). All the reoperated patients underwent a laparoscopic approach, none was managed in a multiple organ failure stage and the recovery was uneventful with discharge occurring in a median of 13 postoperative days (range 7-24 days). The morbidity rate within 30 days of surgery was 24.8% and the mortality rate was 0%.[34]

McKenna et al. conducted a retrospective cohort study based on a multi-institutional database to determine the safety of same-day and next-day discharge succeeding elective laparoscopic colorectal resection and evaluate patient and operative characteristics that could influence early discharge. Patients that were included in the study underwent elective laparoscopic segmental colectomy with primary anastomosis due to a diagnosis of diverticular disease, inflammatory bowel disease, benign neoplasm or malignancy, and since the purpose was to compare early discharge with a more standard discharge time, patients who were discharged after postoperative day 5 were excluded. Other factors that determined exclusion from the study included nonelective operation, concurrent ileostomy creation, ventilator dependence, ASA class IV and individuals who developed in-hospital complications. Patient discharge was either early (postoperative day 0 or 1), intermediate (postoperative day 2) or standard (postoperative day 3 to

5). The main outcomes measured were early readmission (within 7 days of surgery), anastomotic leak, ileus and overall readmission. Of a sample of 36,526 patients, 902 (2.5%) were discharged early, with 75% being ≤ 69 years old. Other than hypertension, comorbidities were infrequent in the early discharge cohort and similarly rare in the intermediate and standard discharge groups. However, early discharged patients tended to have shorter median operative times, operative indication was more likely to be benign neoplasm and they were submitted to fewer low pelvic anastomosis. The early readmission rate was merely 2% in the early discharge cohort, the leading reason being ileus/obstruction followed by bleeding complications. The only comorbidity linked with early readmission was preoperative diagnosis of diabetes mellitus, present in 27% of the early readmitted patients vs 11% of those who were not. Rates of anastomotic leak (0.6% early, 1.0% intermediate, 1.2% standard), ileus (1.9% early, 1.5% intermediate, 2.1% standard) and 30-day readmission (4.8% early, 5.1% intermediate, 5.8% standard) were similar to inferior in the early discharge group compared to the intermediate or standard discharge cohorts. Other postoperative complications such as reoperation were also similar between the three groups. Adjusted analysis demonstrated that early discharge was not associated with greater odds of anastomotic leak, ileus or readmissions.[35]

- Adrenalectomy

At two academic medical centers, Gartland et al. assessed the safety of adrenalectomy on an ambulatory basis using three minimally invasive approaches. Patients who had minimally invasive adrenalectomies were identified (laparoscopic posterior retroperitoneoscopic, laparoscopic transabdominal and robotic transabdominal adrenalectomy). Patients who had other organs removed, bilateral adrenalectomies or were admitted before the day of surgery were omitted. There were no strict, upfront eligibility criteria for ambulatory management, and every patient was preoperatively instructed that same-day discharge was likely, irrespective of age, comorbidities and indication for the operation. The final decision happened on the same day of surgery, determined by the case characteristics, postoperative recovery and the individual's overall readiness to be discharged, which would often hinge on the time of day, distance between hospital and residence and the support available at home. In this retrospective analysis, 203 patients were included, of which 99 (49%) underwent same-day discharge, on average 3.5 h after surgery (range 2.5-5). The overall median age and BMI was 56 years and 30 kg/m^2, respectively. Most patients were ASA class III (67.5%). In the ambulatory cohort, 11 patients had > 70 years of age, 11 had a BMI > 40 kg/m^2, seven had a tumor size > 6 cm, 14 had pheochromocytoma as the surgery indication, 14 had

Cushing's syndrome as the reason for the procedure, 63 (64% of patients) had an ASA score >II and 69 (70%) had their operation completed after 12 pm. Age, BMI, ASA score, type of procedure, tumor laterality or total time under anesthesia were not significantly different between the ambulatory and inpatient group. The ambulatory group was more likely to have lower estimated blood loss (EBL), surgery finish before 3 pm and reason for surgery being nodule/mass and primary hyperaldosteronism instead of pheochromocytoma, Cushing's syndrome or metastasis. Overall 30-day complication proportion was 9.9% and 30-day readmission proportion was 4.9%. Both univariate and adjusted analysis revealed that day-case adrenalectomy was not linked with higher 30-day complication or readmission rates.[36]

Shariq et al. described the outcomes of laparoscopic adrenalectomy in the ambulatory setting in a multi-institutional cohort of patients. Patients submitted to laparoscopic adrenalectomy were screened, with the only diagnostic indication of interest being benign adrenal disease. Exclusion criteria included bilateral adrenalectomies, conversion to laparotomy, major concurrent procedures, diagnosis of pheochromocytoma, emergency operations, age < 18 years, ASA classification ≥ IV or unknown and certain preoperative medical conditions (systemic inflammatory response syndrome, pneumonia, acute renal failure, sepsis, septic shock, open wounds, need for blood transfusion within 72 hours prior to surgery, ventilator dependency and dialysis). The sample included 4,807 patients, 88 (1.8%) of which were submitted to ambulatory adrenalectomy (same-day discharge) and 4,719 (98.2%) were admitted after surgery. Overall median age was 52 year and BMI 29.9 kg/m^2. The ambulatory group included fewer obese (37.2% vs 50%) and ASA class III (45.5% vs 61%) patients, more cases of primary aldosteronism (4.8% vs 6%) and shorter median operative duration (92 min vs 120 min) than the inpatient group. Overall 30-day complication percentage was 4.4%, with no statistically difference in the ambulatory versus inpatient groups. Merely four complications in three ambulatory patients were documented: three cases of infection (two surgical site infections on D13 and D24; one sepsis on D14) and one case needing a blood transfusion on D1. The incidence of overall mortality in the 30 postoperative days was low (0.2%), with no deaths in the ambulatory group. Overall 30-day readmission percentage was 3.4% per 30 person days and greater in the ambulatory than the inpatient group. Most common reasons, apart from "unknown", were bleeding, hormone related, infection and electrolyte/fluid inbalance. The multivariable analysis did not show a relation between discharge on the same day of the operation and higher 30-day complication rate. Operative time ≥ 161 minutes was independently linked with overall adverse events, and risk factors that were also independently associated include smoking, ASA class III, congestive heart failure, diabetes and anemia. The diagnosis of primary aldosteronism demonstrated a protective effect against postoperative morbidity. Moreover, the adjusted analysis

did not show same-day discharge to be independently linked with 30-day readmission. Factors that were independently linked with readmission include obesity, ASA class III and chronic obstructive pulmonary disease.[37]

Gynecologic surgery

- Myomectomy

A 2016 retrospective study evaluated the safety and feasibility of minimally invasive myomectomy with discharge on the same day of surgery by assessing readmissions and visits to the emergency or urgent care within 48 hours, 7 days and up to 3 months after surgery. The study sample included 403 patients undergoing minimally invasive myomectomies, of which 47 (12%) were excluded due to postoperative admission, with reasons for admission including surgeon preference (49%), intraoperative blood loss or anemia (19%), urinary retention (9%), pain management (6%) or nausea (4%). The remaining 356 (88%) patients underwent same-day discharge (defined as discharge on the same calendar date as the procedure or in < 12 h after the procedure close time) and were included in the study. The cumulative readmission rates were 0.6% at 48 hours and 1.4% at 3 months, with two individuals being readmitted in 48 hours due to fever and three others readmitted after 48 hours but within 3 months owing to ileus, epigastric hematoma and acute pyelonephritis. No readmissions necessitated re intervention or represented a life-threatening event. No patients had an urgent care clinic visit within 7 days and 3.4% visited the emergency department within 7 days for complications associated to the postoperative period, with pain or urinary retention being the most common.[38]

Another study compared the operative outcomes and safety protocols of patients undergoing laparoscopic-assisted myomectomy (LAM), using reversible occlusion and permanent ligation of the uterine artery as a blood loss control measure, performed by the same surgeons at a free-standing ASC versus a hospital outpatient environment. In total, 588 individuals underwent LAM at the ASC and 228 at the hospital, with comparable case complexity parameters between settings. The same-day discharge frequency was 98% from the ASC and 70% from the hospital. Five ASC individuals (0.9%) were transferred to the hospital, with four requiring blood transfusions and one due to postoperative asthmatic reaction with low oxygen saturation. In the adjusted analysis, the blood transfusion proportion was significantly inferior in the ASC (2%) compared to the hospital (6.5%). No conversions to hysterectomy occurred in either setting and two conversions to standard laparotomy occurred only in the hospital setting. The rate of intra- and post-operative adverse

incidents was comparable, and the EBL did not statistically significantly differ between both environments. The average operative duration was significantly lower in the ASC (68 minutes) compared to the hospital (80 minutes). The surgical safety protocols were equivalent in terms of intraoperative surgical safety standards, but varied in the thresholds for preoperative hemoglobin, nurse-patient ratio in the PACU and scheduling of the procedure. Since the ASC does not have intraoperative blood transfusion capacity, blood counts are acquired just prior to surgery and the minimum preoperative hemoglobin value required is 9.0 g/dL. In the hospital setting, the minimum hemoglobin level is 7.5%, acquired within 30 days of surgery. The nurse-patient ratio is 1:1 within the ASC recovery room but routinely higher at the hospital. LAM procedures are only scheduled in the morning at the ASC to increase observation and recovery times prior to discharge. The thromboprophylaxis strategies are similar, using sequential compression devices (SCD) and thromboembolic disease (TED) hoses depending on the level of risk. However, whilst individuals at high risk who required SCD were sent home from the ASC with a portable and battery operated SCD, in the hospital they were admitted and monitored for appropriate thromboprophylaxis up to discharge.[39]

- Hysterectomy for malignant disease

Lee et al. analyzed the preoperative and intraoperative factors influencing discharge on the same day of surgery following laparoscopic hysterectomy for endometrial cancer, in addition to the 30-day postoperative complications. From 9,020 cases of laparoscopic hysterectomies for endometrial cancer, 729 (8.1%) were discharged home on the same day of the procedure and 8,291 (91.9%) were admitted. Some of the risk factors associated with admission after laparoscopic hysterectomy encompassed age, BMI and preoperative medical conditions (including chronic obstructive pulmonary disease, diabetes and hypertension requiring medication). Operative and anesthesia times, concomitant lymph node dissection and radical versus simple hysterectomy and total number of relative value units were analyzed in order to assess surgical complexity variations. The admitted patient population showed lengthier median operative duration (164 min vs 131 min) and median anesthesia time (254 min vs 235 min), higher median total number of relative value units (31.6 vs 27.0) and more lymph node dissections (59.8% vs 50.5) or radical hysterectomies (18.9% vs 7.4%). The rates of complications were similar between admitted and same-day discharged patients, with the exception of surgical site infections, which were superior in the admitted cohort (1.0% vs 0.1%). The rate of complications was additionally compared between the same-day discharged group and those admitted for one hospital day, and there were also no

significant distinctions. The reoperation and readmission frequencies of those who were discharged on the same day of surgery were comparable to those who were admitted.[40]

Praiss et al. analyzed the outcomes of same-day discharge following minimally invasive hysterectomy for endometrial cancer. The study included 1,828 (12.4%) woman who underwent discharge on postoperative day 0 (the day of surgery) and 12,892 (87.6%) woman whose discharge happened on postoperative day 1 or after. Older age (≥ 70 years), obesity (≥ 30 kg/m^2), chronic obstructive pulmonary disease and hypertension were associated with decreased likelihood of discharge on the same day of surgery. Increasing operative times decreased the probability of same-day discharge. Undergoing lymphadenectomy increased the likelihood of same-day discharge. Overall complication rate was 2.1% in the same-day discharge group and 2.6% in the discharged on postoperative day 1 group. The readmission rate was 2.3% in those who underwent same-day discharge and 3.1% in those discharged on postoperative day 1. Same-day discharge showed no association with readmission in the multivariable model analysis. In the same-day discharge group, longer operative duration and development of a perioperative adverse event were related with readmission.[41]

Matern et al. compared the readmission of patients discharge under and over 12 hours to investigate factors influencing the safety and feasibility of ambulatory robotic-assisted hysterectomy for endometrial or cervical cancer. The sample included 254 patients, of which 44 (17.3%) were treated for cervical malignancy and 210 (82.7%) for endometrial cancer. Of the overall sample, 150 (59.1%) underwent a LOS > 12 hours whereas 104 (40.9%) had a LOS < 12 hours. Of the past medical and surgical risk aspects, a history of venous thromboembolism (VTE) was the only one significantly linked with failure to attain a LOS < 12h. Multiple surgical risk factors impacted discharge time. Preoperatively, surgeries that started after 3 pm were more likely to lead to an overnight admission. Intraoperatively, operating room duration > 180 minutes and uterine mass > 150 g were associated with a LOS > 12h, whereas EBL > 150 mL, vaginal laceration as well as other genitourinary injuries did not influence LOS. Performing additional procedures with hysterectomy did not increase the risk of overnight stay. Postoperatively, inadequate analgesia, emesis and VTE formation were associated with unsuccessful discharge < 12 hours. Readmissions were not more frequent in patients discharged in under 12 hours than in those discharged over 12 hours after surgery. Causes for readmission comprised pelvic abscess, fistula development, wound abscess, acute hypotension and urinary retention.[42]

Vascular surgery

- Endovascular aneurysm repair

Sousa et al. conducted a retrospective, unicentric study to evaluate the outcomes of individuals with aorto-iliac aneurisms that were successively submitted to percutaneous endovascular aneurysm repair (PEVAR) with the Preclose closure technique, using local anesthesia, observing the concept of one day surgery (one overnight stay and discharge 24 hours after surgery). All the cases included in the study were elective, with emergent or rupture cases being excluded. Surgical planning and selection of the stent-graft were carried out by skillful vascular surgeons, considering the anatomic characteristics of the patient and invariably respecting the instructions for use. An ultrasound-guided percutaneous access with double Preclose Proglide closure technique was planned for all patients, as long as the appropriate anatomical conditions were met. Presence of a common femoral artery aneurysm or severe atherosclerotic disease with total occlusion were considered exclusion criteria. Presence of circumferential calcification of the access artery was not a contraindication to percutaneous access, provided that the preoperative ultrasound study revealed a suitable area for puncture. The arterial diameter of the access vessel was also evaluated in all procedures, to ensure that percutaneous access and closure were only applied in patients with appropriate anatomical conditions. Excess weight was not considered an exclusion criterion. Observing the one-day surgery model, all patients remained hospitalized for one night after surgery and were reassessed by the surgical team for up to 24 hours afterwards. Individuals with satisfactory intraoperative angiographic results, who were clinically well on reassessment, with good renal function and no major medical comorbidities or local complications of percutaneous closure were discharged home, after being instructed about who they should contact in case of need and explained the warning signs that should prompt revaluation. Twenty consecutive patients were treated with PEVAR and local anesthesia, of which 95% (19) had an abdominal aortic aneurysm and 5% (1) had a common iliac aneurysm. They were all male and had a mean age of 75 years (range 61-88). In this sample, 55% (11) individuals were smokers, 75% (15) suffered from hypertension, 60% (12) from dyslipidemia, 30% (6) from coronary artery disease and 15% (3) from type 2 diabetes mellitus, however none suffered from chronic kidney disease (GFR < 90 mL/min/1,73 m^2). Circumferential calcification of the femoral artery was discovered in 9.5% (2) of cases, but the ultrasound-guided access allowed the identification of a suitable area for puncture and the application of the percutaneous closure device in every case. Every implant was successfully executed, with an initial endoleak proportion of 10% (2), with one case of type 1a endoleak that was successfully corrected in the intraoperative period and one case of type 2a endoleak that was diagnosed in the first postoperative imaging control and sealed spontaneously on the second one.

All patients were clinically stable after 24 hours, without any cardiac morbidity, acute kidney injury or limb ischemia. Percutaneous closure had an initial technical success of 97.5% (39 access procedures), with one diagnosis of a femoral pseudo-aneurism 6 hours after the procedure that was later corrected via percutaneous thrombin injection. The presence of circumferential calcification of the access artery showed no statistically significant association with the occurrence of complications. There was no case of arterial stenosis after closure. Median LOS consisted of 1 day (range 1-10), with 95% (19) of patients being discharged at 24 hours from surgery and the individual who developed the pseudo-aneurysm being hospitalized for 10 days. On average, every patient was reassessed 2 weeks, 1 month and 6 months after the intervention. An abdominal-pelvic CT angiography was performed after 1 and 6 months from surgery. At 6 months, if there was no endoleak or expansion of the aneurysmal sac, patients were reassessed every 12 months by CT angiography or abdominal Doppler ultrasound, at the judgement of the surgeon in charge. No prosthetic migration or *de novo* endoleak were documented at the first two imaging controls. The singular case of type 2a endoleak underwent spontaneous sealing, evidenced by the control CT angiography at 6 months, a finding that was maintained in the subsequent imaging controls. Average follow-up time was 11.4 months (range 1-36). There were no readmission, reintervention or mortality from any cause reported.[43]

Hanley et al. endeavored to assess if same-day discharge of selected individuals submitted to elective EVAR was safe and feasible, in addition to validate their selection criteria to identify candidates for this approach. Thus they compared a prospective, single-center cohort of patients scheduled for same-day discharge with a retrospective historical control cohort (all the EVAR cases from the preceding 2 years that met the same criteria for an ambulatory approach). Inclusion criteria to identify potential candidates for same-day discharge were infrarenal abdominal aortic aneurysm planned for programmed EVAR; low surgical risk (based on medical conditions); and responsible adult available to accompany the patient for the first 24 hours following discharge. Exclusion criteria were medical (comorbidities, anticoagulation needing in-hospital bridging, emergent or urgent repair); technical (planned aortic arch, thoracoabdominal, complex, branched or fenestrated endovascular repair, planned surgical bypass or concurrent intervention needing admission, vascular surgeon's judgement about the feasibility of discharge on the same day of surgery); or social. When assessing suitability, specific anatomic criteria were not considered. Of a total of 266 patients prospectively assessed, 110 (41%) were planned for same-day EVAR and composed the ambulatory EVAR group. Causes for not planning same-day discharge were technical (49%), medical (34%) and social (17%). Of a total of 327 patients that underwent EVAR in the 2 years before the study, 202 (62%) fulfilled the inclusion criteria and formed the historical control group.

Causes for exclusion were technical (62%) and medical (38%). The demographic data was equivalent between the two groups, however there were significantly more percutaneous access (89% vs 10%), less use of contrast material (81 ± 41 mL vs 93 ± 47 mL) and lower operative times (98 ± 39 min vs 124 ± 36 min) in the ambulatory EVAR cohort, with additional operative variables being similar. In the ambulatory EVAR group, LOS was shorter on average 2 days (0,7 ± 2,6 days vs 2,5 ± 6,9 days), with 79% individuals undergoing same-day discharge and 93% (vs 51% in the historical control cohort) being discharged by the following day (LOS ≤ 1 day). Unsuccessful same-day discharge was due to 14 technical (concomitant procedure, conversion to aortouni-iliac configuration, endoleak and hemostasis), 8 medical (abdominal pain, syncope, chest pain, transient ischemic attack, non-ST-segment elevation myocardial infarction, hematuria and long-acting spinal anesthetic) and one social (late time of surgery completion) causes. Perioperative adverse incidents (11% vs 9%), readmission (2% vs 4%), reoperation (4% vs 4%) and mortality (1% vs 1%) frequencies were comparable between the ambulatory EVAR and the historical control cohorts. Conversely, emergency department visits (15% vs 6%) were significantly higher in the same-day discharge group, with reasons including problems with the access site, fever, urinary retention, constitutional symptoms and vascular complications (limb occlusion and deep venous thrombosis). It is worth mentioning that merely one emergency department visit led to readmission, due to a graft limb occlusion in the postoperative D30 that needed reintervention. Failed same-day discharge was linked with use of general anesthesia (26% vs 6%), increased blood loss (90 ± 70 mL vs 310 ± 290 mL), greater operative times (90 ± 33 min vs 126 ± 49 min) and more unplanned operative adjuncts (48% vs 22%). In addition, a non-statistically significant tendency toward surgical cutdown was observed (22% vs 8%).[44]

Logistical factors

The primary objective of a 2020 single-center prospective cross-sectional observational study was to analyze postoperative severe complications in day surgery, expressed as conversion to conventional hospitalization or visits to the emergency department in the 30 days after discharge. It addition, a secondary objective consisted of assessing the socioenvironmental profiles of the patients and determine predictors for severe adverse events. The sample consisted of 598 ambulatory individuals, with an average age of 50.8 years. The proportion of severe complications was 3.68% (1.84% conversions to conventional hospitalization and 1.84% conversions to emergency department visit, three of which resulted in readmission). Of the 11 conversions to conventional hospitalization, six were due to medical factors, three to organizational factors (late surgery

conclusion not compatible with discharge on the same day) and two to surgical factors. Regarding socioenvironmental characteristics, 116 patients (19.7%) lived by themselves but were not socially isolated, 15 (2.6%) lived by themselves and were isolated and 13 individuals (2.2%) had a language barrier. After day surgery, 9 patients (1.6%) went home on foot, 20 (3.4%) by public transport and 8 (1.4%) drove home. 133 patients (13.7%) were alone the first night after the operation. The rate of severe complications was not significantly different depending on socioenvironmental characteristics.[45]

A single-institution retrospective cohort analysis evaluated the factors leading to failed discharge and unanticipated admission following ambulatory surgery. Failed discharge was defined as unanticipated admission or delayed discharge past the day surgery unit closure time. Of the 5,156 patients included in this study, 5,011 patients were discharged home successfully and compared with 145 patients who underwent unplanned admission (incidence of unanticipated admission was 2.89%). Main causes for admission were social/organizational (45.52%), surgical (38.62%), anesthetic (10.34%) and medical (5.52%). Time of operation completion after 3 pm represented 8% of unanticipated admission and lack of an escort or support available at home represented 9%. Thirty-one patients (0.6%) had a delayed discharge from the recovery unit, mostly due to the surgical intervention starting at a late time (67.74%). Multivariable logistic regression revealed ASA class, time of surgery completion, length of surgery and severity of illness score to be predictive factors for admission.[46]

DISCUSSION

Ambulatory surgery has greatly expanded throughout the last decades, as a consequence of improvements in minimally invasive surgical techniques and anesthesia care , as well as increasing costs with healthcare, long waiting lists and pursuit of greater perioperative comfort.[3] As the surgical volume of ambulatory surgical procedures increases, the careful selection of patients is fundamental for resource management efficiency and risk minimization.

In the past, guidelines for ambulatory surgery selection criteria used to be much stricter. As an example, in 1985 the Royal College of Surgeons of England required an age < 65 years, an ASA status of I or II, a BMI inferior to 30 kg/m^2 and that the operating time did not exceed 60 minutes. By the turn of the 21th century, as day surgery started to emerge as the new standard of treatment in many countries and a greater number of patients presented for surgery with multiple comorbidities, older age and increased BMIs, the selection criteria became more inclusive and comprehensive.[3]

The most frequently analyzed outcomes when determining eligibility for day surgery consist of perioperative morbidity, unanticipated admission and readmission. Identification of perioperative predictive factors of day surgery failure and stratification of risk contribute to informed eligibility and prevention of adverse outcomes. As previously stated, ambulatory surgery criteria can be divided into medical, surgical and logistical factors, and the strength and pertinence of the results obtained are discussed below.

Medical factors

Once a patient is on a day surgery pathway, they should undergo a preoperative evaluation in order to assess patient suitability, identify and minimize risks and develop a surgical and anesthetic plan. It includes, among other, medical history taking, physical examination, pre-anesthesia evaluation and perioperative risk assessment.[11] Treatment for any pre-existing conditions should be optimized before surgery.[2]

Elderly

A person is generally considered an elderly when their age is 65 years or older.[47] Due to the growth in the aging population, longer life expectancy[48–51] and improvement of day surgery

outcomes in older individuals,[13] an increasing number of older patients is presenting to health care services, including ambulatory surgery.[16] This population represents a unique challenge to the surgical team since it is associated with higher morbidity, mortality and risk of cognitive dysfunction along with reduced physiological reserve as a result of aging and frailty.[48] There are several advantages to day surgery, such as early mobilization, faster return to preoperative physiologic condition, lower costs, improved patient satisfaction and, particularly for the geriatric population, less cognitive dysfunction.[52] It has been demonstrated that complications and mortality increase with major surgeries in the elderly,[53] but the outcomes of day surgery in these patients are not as well known.[16]

Early discharge of patients of all ages is becoming more common after laparoscopic cholecystectomy, in part as a result of the progress of minimally invasive approaches, resulting in faster recovery and reductions in healthcare costs. A retrospective study of 207 cases showed that age is not a barrier for day-case laparoscopic cholecystectomy in selected patients, with similar rates of early discharge between patients under and over 75 years of age.[13] Additionally, another study which included 120 "high acuity" patients concluded that ambulatory sleeve gastrectomy can be safely performed on select "high acuity" patients, including those with ≥ 65 years of age, in a free-standing ambulatory surgery center.[14]

Contrarily, Wu et al. observed that the age of the patient was an independent predictor of admission after ambulatory OHNS on OSA patients, which indicates that caution is advised in the selection of elderly individuals for day surgery.[15] Moreover, a study with a sample of close to 390,000 patients that examined the relationship between age and postprocedural outcomes of ambulatory surgeries with general anesthesia showed that being ≥ 80 years old was an independent predictor of same-day admission, complications, readmission and mortality. The fact that the association remained after controlling for confounding factors emphasizes the complexity of age-related physiological changes.[13,16]

Evidence suggests that age alone should not be used as an exclusion criteria for ambulatory surgery, but instead taken into account together with other aspects like physiological condition, functional limitation and comorbidities to determine which patients have a higher probability of experiencing adverse events. As such, an exhaustive preoperative assessment coupled with extensive intra- and post-operative planning may be of service in reducing adverse outcomes and improving the safety of older patients.[16]

Frailty

Frailty is a measure of reduced physiological reserve correlated to deficits in multiple organ systems and it is possible to differentiate it from the aging process and comorbidity. It increases vulnerability to a stressor and has been linked with morbidity and mortality in major programmed and emergency general surgeries, independent of age.[54] There is not many evidence regarding how frailty impacts the outcomes of individuals undergoing day-case general surgery, which would contribute to risk stratification, better informing older patients about the surgery's risks, increase the access to care for the elderly non-frail population and plan prior to surgery in order to modify risk factors and achieve better surgical results.[17]

Seib et al. showed that higher modified frailty index were linked to a stepwise increment of the occurrence of perioperative adverse incidents in common ambulatory general surgeries, independent of age, type of anesthesia and other comorbidities. The most common medical conditions that increased frailty were diabetes, coronary artery disease and hypertension, therefore it is important to signal their coexistence in the preoperative assessment. The results highlighted the importance of considering frailty, more than chronological age, when selecting and preparing individuals for ambulatory surgery, and that informed consent should be influenced by frailty to guarantee that patients have an adequate understanding of the operative risks when deciding whether to proceed with surgery. Nonetheless, the complication rates and adjusted odds ratios were indeed higher for patients aged ≥ 80 years old, indicating that additional attention should be given to this population when determining eligibility based on risk modification and the indication for surgery. It is important to consider that the mFI was chosen as a measure of frailty since it has been validated and used in prior studies, but it provides an incomplete overview of patient frailty and additional assessment of mobility, cognition and functional status would have permitted a more thorough evaluation.[17]

Rothenberg et al. findings suggested that frailty, as measured by the Risk Analysis Index, is a significant risk factor for unanticipated readmissions following ambulatory surgery, both independently and when partially mediated through increased adverse incidents. Frailty is not characterized solely by age or comorbidities, and the RAI incorporates other key impairments within the physical, nutritional, functional, social and cognitive components of frailty. In addition to recognizing and minimizing complications, these findings show that screening for frailty has an important role in the preoperative identification of those with a higher risk for postprocedural complications and the design of perioperative interventions that can reduce unplanned readmissions after day surgery.[18]

ASA Physical Status

The ASA PS Classification System is intended to evaluate and transmit the patient's pre-anesthesia medical condition. It has the potential to aid in the prediction of perioperative risks for surgeries performed under anesthesia, especially when combined with other factors.[20] In light of the steady clinical trend of moving towards ambulatory surgery, it is essential to validate surgical risk stratification tools in this environment to better prevent poor perioperative outcomes. The preoperative risk stratifying utility of ASA PS classifications has been frequently assessed for inpatient surgical procedures, however the evaluation of its value in the ambulatory setting is lacking.[19]

A pioneer observational study with a large sample size proposed to examine this question, and its findings support the application of ASA PS classification as a straightforward and accurate preoperative risk stratifying tool for ambulatory surgeries across multiple specialties and anesthesia modalities. Higher ASA PS score was related with increased morbidity and mortality within the ambulatory setting. ASA PS IV was linked with an 89 times higher rate of mortality following day surgery in comparison to ASA PS I (healthy patients). As such, inpatient surgery is likely the safest setting for these high-risk cases since intravenous medication, tight monitoring and medical assistance can be easily attainable postoperatively.[19] Wu et al. also detected ASA class to be an independent predictor of postoperative admission following day-case OHNS.[15]

Obstructive sleep apnea

Obstructive sleep apnea (OSA) is a common breathing disorder and frequently under-diagnosed. Its prevalence is increasing and is potentially even greater in surgical patients than in the general population. Risk factors include the male gender, increased age and high BMI. These patients may have multiple comorbidities, since frequent upper airway obstructions can lead to arterial desaturations, systemic inflammation and an array of respiratory and cardiovascular diseases with higher mortality.[21,55,56]

OSA is linked with a greater probability of perioperative complications. When submitted to sedation or general anesthesia, patients experience a reduction of the muscle activity in the upper respiratory tract, which can aggravate the symptoms of OSA and increase the risk of airway obstruction, hypoxemia, respiratory arrest and even death. The postoperative use of sedatives and opioids, surgical trauma and residual muscle weakness further enhance the risk for respiratory

complications. Other possible complications include cardiac events, need of ventilator support and intensive care, difficult airway and prolonged lengths of stay.[21]

Several guidelines have been published by authoritative societies describing risks and proposing attenuating strategies when managing surgical OSA individuals. The eligibility of these patients for ambulatory surgery is still grounds for disagreement due to safety concerns and limited evidence. In 2012, the Society for Ambulatory Anesthesia (SAMBA) emitted a consensus stating that individuals with a known diagnosis of OSA and optimized treatment of comorbidities can be considered for day surgery, provided they are able to use a continuous positive airway pressure device in the postprocedural phase. In case of presumed diagnosis of OSA, based on screening instruments like the STOP–Bang questionnaire, and with optimized comorbidities, patients can also be considered for day surgery, granted that postoperative pain relief can be mainly achieved through nonopioid analgesic methods.[55] In contrast, the 2014 updated report by the American Society of Anesthesiologists on perioperative management of OSA patients determined that "the literature is insufficient to offer guidance regarding which patients with OSA can be safely managed on an inpatient *versus* on an outpatient basis".[57] The Society of Anesthesia and Sleep Medicine guidelines on preoperative screening and assessment of OSA patients (2016) and on intraoperative management of OSA patients (2018), despite not being specific for ambulatory surgery, recommend the preoperative screening of surgical patients for OSA, the utilization of positive airway pressure therapy and a cautious selection of anesthetic techniques and drugs when managing OSA patients.[56,58] Since OSA patients are more likely to have difficult intubation and need mask ventilation, precaution is advised with propofol, opioid medications, benzodiazepine sedation or neuromuscular blocking agents for they can increase the risk for adverse events.[58] The STOP-Bang questionnaire is a validated instrument for the screening of this condition, and greater scores represent an increased risk of moderate-to-severe OSA.[55,56]

Szeto and al. demonstrated that there was no association between the risk of or previous diagnosis of OSA and length of stay, relocation to a hospital, urgent care center visit and readmission after day surgery. Although the high-risk and diagnosed OSA group had a greater rate of postprocedural complications, they neither had an effect on discharge nor resulted in increased transfers to a hospital. Therefore the data supports that at-risk or diagnosed OSA patients can undergo day-case oncology surgery without extended hospitalization or increased readmission or adverse outcomes, in a protocolized perioperative management pathway. Furthermore, since this facility screened patients for OSA with the STOP-Bang questionnaire, preoperatively assessed and optimized any comorbid medical condition and set up clinical pathways with multimodal analgesic

techniques with limited opioid use for those scheduled as ambulatory surgery with extended recovery, these findings also reflect the implementation of current consensus and evidence-based guidelines proposed by professional societies to the OSA population.[21]

Furthermore, for similar airway surgery procedures for OSA on patients with very similar characteristics the probability of postoperative complications and readmissions was comparable in the inpatient versus ambulatory setting. However, prospective studies are needed to determine what percentage of OSA patients submitted to inpatient airway surgeries could be moved to an ambulatory setting without worsening their outcomes.[22] Wu et al. also demonstrated that a vast majority of OSA individuals do not need to be admitted after day-case OHNS, regardless of indication and type of surgery, which suggests that policies should be based on risk stratification when deciding which OSA patients to admit following day surgery as a means to decrease admission rates as well as reduce healthcare costs.[15]

With adequate preoperative screening for OSA, evaluation and optimization of any comorbidities and limited use of opioid agents, many at-risk or diagnosed OSA individuals are suitable for day surgeries. The determination of performing airway surgery in the ambulatory setting should be made on an individual basis, considering the anesthesiologist and surgeon assessments in addition to the type of ambulatory surgical facility. Although the body of evidence regarding perioperative outcomes of OSA patients in the ambulatory setting is growing, it is necessary to design more prospective and multicenter studies with larger sample sizes, as well as assess the outcomes of different types of facilities, in order to support the retrospective findings of the studies detailed above and strongly inform guidelines on this topic.[21,22]

Obesity

The prevalence of obesity continues to grow worldwide, particularly the morbid obesity (BMI ≥ 40 kg/m^2) and super morbid obesity (BMI ≥ 50 kg/m^2). It has been cited as a predictor of perioperative adverse events and readmissions in day surgery.[29,59] In addition, it is frequently concomitant with various comorbidities, such as pulmonary and systemic hypertension, cardiomyopathy, diabetes mellitus, obesity-related hypoventilation syndrome and OSA, which also correlate with perioperative adverse events.[28,59,60] Specifically, cardiovascular, pulmonary, renal and thromboembolic complications have been observed.[61] Moreover, obesity can present challenges for the anesthesiologist relating to a greater incidence of difficult airway,[62] securing adequate airway management,[59] increased probability of position-related nerve injuries and

compartment syndrome[63], ensuring the monitorization of hemodynamic and respiratory variables or establishing an intravenous access.[26] From a surgical point of view, technical difficulties can emerge throughout the operation, and greater operative times, loss of blood, reoperation rates and risk of infections have been described.[26,64]

The adequate selection of obese individuals for day surgery and whether a BMI cut-off should exist remain a source of contention. While it is generally established that class 1 and 2 obesity can safely undergo ambulatory surgery if comorbid conditions have been optimized, it is not yet clear what BMI interval within class 3 obesity is deemed safe, especially when significant medical conditions coexist.[28,29,59] Although BMI may not be the most reliable metric for obesity, it is the most frequently used.[25]

On one hand, several studies showed that obese patients had similar outcomes to the non-obese, including upper BMIs ranges. Therefore, ambulatory surgeries are safe and effective for a great proportion of obese patients, including class 3 obesity, who otherwise meet the eligibility criteria, after careful preoperative evaluation and optimization of medical comorbidities. Experienced surgeons, adequate protocols and consistent operative teams are also advantageous.[14,24–26]

On the other hand, one of the two study regarding ambulatory laparoscopic cholecystectomy showed that patients who were super morbidly obese (BMI ≥ 50 kg/m^2) experienced modestly higher odds of admission, but no higher odds of same-day adverse incidents. As such, although the super obese patients can safely undergo day-case laparoscopic cholecystectomy, each case should be discussed individually, taking into account the increased odds of requiring inpatient admission, and the best location for the procedure (free-standing versus hospital-based) weighted.[27] As for arthroscopy patients, a significant amount of morbidly obese patients, which constitute a great fraction of individuals submitted to joint arthroscopy, can safely undergo ambulatory joint arthroscopy if other eligibility criteria are met and comorbid conditions are optimized. However, the super morbidly obese experienced greater odds of hospital admission following day surgery, even when patient's comorbidities were controlled, indicating that a BMI ≥ 50 kg/m^2 could preclude patients from day surgery. They would need a thorough preoperative evaluation, medical optimization and closer perioperative monitoring to detect and treat any postoperative complication as soon as possible in order to be safely managed on an ambulatory basis. Also, the intervention should ideally take place in a setting which permits extended stay.[28] Another study found that individuals with a BMI ≥ 40 kg/m2 had around a 30% greater probability of same-day hospital admission after ambulatory tonsillectomy, but no greater likelihood of 30-day readmission.

Whether such results are clinically relevant enough to exclude this patient population from day-case tonsillectomies will depend on the ambulatory surgical facility and resources available, but comorbidities and surgical procedure should also be taken into account.[29]

Obesity alone should not be considered an absolute contraindication for most types of surgeries on an ambulatory basis. Evidence is still limited to assert definite recommendations regarding BMI thresholds, but those with a BMI ≥ 50kg/m^2 should be thoroughly assessed case-by-case. The results indicate that perhaps instead of defining a common BMI cutoff for all ambulatory surgeries, it may be more sensible to determine the effect of BMI on the outcomes of different types of surgeries based on anatomical site, and surgery-specific limits devised if clinically warranted.[29]

Surgical factors

A growing variety of surgeries in all specialties is being successfully performed in an ambulatory framework, as a result of the development of minimally invasive procedures, anesthesia techniques and enhanced recovery after surgery (ERAS) pathways.[33,36] Most surgical procedures can be performed as day-case or short-stay surgery.[3] However, when the surgeon anticipates an operation to be too invasive, extensive or complicated for a certain patient, day surgery should be precluded.[7]

In the United Kingdom, a list of 25 procedures for day surgery was released by the Audit Commission in 1990, later revisited in 2001. Since then, medical advancements have led to an increasing variety and complexity of interventions to be deemed appropriate for ambulatory surgery, and as a result the British Association of Day Surgery expanded said list to over 200 procedures.[2] The general principles of surgical selection for day surgery include:

- Use of minimally invasive techniques on abdominal and thoracic interventions;
- The extent of induced trauma is more significant than the procedure's duration (in the past, procedures had to be < 90 minutes long but nowadays operating times up to 4 hours are common);
- Postoperative pain should be easily managed with oral analgesics and local/regional anesthesia;
- It is expected that oral intake resumption occurs within a few hours (not necessarily with solid food, liquid dietary supplements are sufficient);

- Low risk of major postoperative complications necessitating immediate medical attention, such as severe blood loss or obstructed airway;
- Prolonged specialist postoperative care or observation should not be needed;
- Patients should have the ability to mobilize before discharge, whether or not with aid (complete independent mobilization and capacity to walk up the stairs is not a requirement);
- The procedure must be performed by highly qualified surgeons with considerable experience and low complication rate.[2,3]

Some urgent or emergent surgeries can be performed on a semi-elective ambulatory pathway. Patients are evaluated in the hospital, discharged home and posteriorly return to be intervened at a convenient time. This can be achieved if the procedure is adequate for same-day discharge and can be postponed for a few days, clear emergency day surgery pathways exist and the condition is safely manageable at home with oral analgesia.[2,3]

General surgery

- Appendectomy

One of the main indications for emergency general surgery is acute appendicitis.[65] The reference treatment continues to be laparoscopic appendectomy, and it is a procedure that is mostly carried out in young healthy individuals that has been shown to be associated with a reduced operating time and median length of stay, brief postoperative recovery, less pain and lower rate of wound infection than open surgery.[31,32] Although these characteristics are promising in the ambulatory setting, three French surgical societies did not include appendectomy in their 2011 recommendations of ambulatory surgery for digestive interventions due to insufficient strong evidence and it being a procedure performed in emergency environments.[31,66]

Aubry et al. showed that the management of individuals with UAA who require urgent surgeries compatible with a short LOS (which could include overnight stay) is feasible in a dedicated 24-h emergency outpatient unit with an experienced clinician staff that does not use conventional surgery beds and permits discharge during the night. Outpatient surgery (with LOS < 24 h) was successful in 87% of UAA cases who meet a protocol that was intended to have a large inclusion of individuals. The median delay of 2h34 between diagnosis and surgery was acceptable, but the median delay of 9h42 between admission to the PACU and discharge could improve. A significant

difference in this delay was observed depending on the time of day the surgery was performed (day time vs overnight), probably due to reluctance in discharging patients in the middle of the night, in particular when surgery occurred between 6 pm and midnight, resulting in longer LOS. [31]

Even though the majority of surgeons consider overnight admission the standard and search for potential candidates for ambulatory surgery, in the study by Gignoux et al. ambulatory appendectomy was offered to all patients, if they met eligibility criteria. The results showed that 59% of uncomplicated as well as complicated appendectomies could be operated in the ambulatory setting, with discharged on the same working day. The proportion of complications was greater in the conventional cohort, but there is a possible bias since it included patients with severe comorbidities. Ambulatory surgery did not show increased rates of unplanned reconsultations, rehospitalizations or reoperations. Appendicolith is a recognized predictor of non-surgical treatment failure that increases the probability of perforation, inflammation, inefficacy of antibiotic treatment and postoperative adverse incidents, therefore in its presence surgical treatment is recommended. In addition, Gignoux et al. unexpectedly observed that it is also an independent risk factor in surgical treatment, since it was associated with unplanned rehospitalization being four times more frequent. As such, appendicitis with appendicolith should be regarded as "complicated", signaling for closer monitoring and prompting postoperative antibiotic treatment. Evidence thus suggests that ambulatory surgery could be the standard of care for both complicated and uncomplicated acute appendicitis. Informing patients with appendicolith of the increased risk of rehospitalization is important, as well as provide them with a closer monitoring, regardless of the setting. [32]

- Colectomy

Besides the advent of laparoscopy, ERAS programs for elective colorectal surgery have largely contributed to a decrease in length of stay and postoperative morbidity and mortality, expanding the potential for ambulatory surgery. [33–35] Previous research has demonstrated that short hospital stays of 23 to 24 hours are feasible, with individuals being admitted overnight. [34] In 2015, Gignoux et al. reported the first case series of colectomies performed in a true ambulatory regime (LOS < 12h) in the international literature, and their preliminary results showed that ambulatory colectomy was feasible. [67] Ambulatory management provides numerous benefits for these patients, since laparoscopy causes a decreased inflammatory reaction compared to laparotomy and, in addition to the multimodal analgesia and early mobilization and feeding, contributes to an

expeditious restoration of gastro-intestinal motility. Patients with a shorter LOS have a reduced risk of nosocomial infections and thromboembolic events.[33,34]

Chasserant et al. reported that all 40 patients were able to undergo same-day discharge apart from one, owing to social reasons. No rehospitalization was needed and the postoperative course was mostly uneventful. These results substantiate the feasibility of ambulatory left colectomy in the majority of patients, including cases involving an ASA class III and more complex operations (when associated interventions are needed).[33] However, it is important to highlight that patients with severe comorbidities were excluded and this study represents a single-institution analysis with a small sample, so caution not to generalize these findings is warranted.

Gignoux et al. contributed once again with pioneering evidence by publishing the first large-scale multicenter study of consecutive patients submitted to day-case colectomy for malignant or benign disease. They confirmed that colectomy on an ambulatory surgery framework is feasible, safe and reproducible for selected patients. The admission rate in this study was 7.0% (11 patients), and since this was the first ambulatory colectomy series published, this rate can be considered as a reference. Some of the unplanned admissions could perhaps have been prevented with a more thorough selection, since three patients had social factors and two had medical conditions that could have been optimized prior to surgery.[34]

In order to assess if successful early discharge pathways could be extrapolated outside of specialized centers, McKenna et al. conducted a multi-institutional analysis and showed that laparoscopic colorectal surgery followed by early discharge (same-day or next-day) did not result in increased complication or readmission rates, in comparison to discharge on postoperative day 3 to 5. Diabetes has been linked with infectious complications, and it was the sole factor that showed an association with readmission. It is important to refer that due to having a term of comparison with more standard discharge days, it was possible to notice that the median surgery times were 1.5 times as long in the intermediate and standard discharge cohorts, suggesting a selection bias of perceived less complex cases for the same-day and next-day discharge group. To contain this selection bias, only patients submitted to laparoscopic surgery who did not develop in-hospital adverse events before being discharged were chosen for this retrospective analysis.[35]

Timely diagnosis of life-threatening complications is crucial in diminishing the gravity and odds of over-mortality. It is a legitimate concern that the lack of formal organization, as well as of a meticulous and obligatory postoperative surveillance, could lead to delays in the detection and management of any potential risk. The three main complications associated with colectomy which

can acutely endanger an individual's life are massive bleeding, anastomotic dehiscence and acute bowel obstruction. However, the likelihood of bleeding is lesser for laparoscopy than laparotomy and the application of novel thermofusion scalpels promotes hemostasis and converts postoperative bleeding into a rare occurrence.[33,34] In the Chasserant et al. study, the fact that postoperative hemoglobin levels remained stable even with early patient mobilization demonstrates the low risk of bleeding.[33] Furthermore, the nurse visits could identify any low-grade bleeding when they record the pulse, pain and hemoglobin level. Anastomotic leakage is a complication that usually arises between D3 and D12, therefore a long time after discharge in the ERAS protocols. In both prospective studies, CRP was included in laboratory testing.[33,34] A study by Singh et al. showed that an early postoperative CRP value raised above 135 mg/L had a negative predictive value of 97% and a positive predictive value of 21% for the occurrence of anastomotic leakage following colorectal surgery. As such, screening for serum CRP is an efficacious negative predictive measure, since a value below the threshold can virtually exclude anastomotic leakage and a value above will lead to further examination, such as abdominopelvic CT scan.[34,35,68] Moreover, in its early stages anastomotic dehiscence elicits clear symptomology that will warn the vising nurse and cause immediate hospitalization,[33,34] and the same can be said for intestinal obstruction.[34] In summary, these three risks can be detected by the homecare nurse checkups, close postoperative follow-up and laboratory testing.[33,34]

Evidence thus show that true ambulatory colectomy can be achieved without compromising patient safety, provided certain recommendations are observed. Rigorous selection criteria must be in place, and individuals should be in good general condition in addition to having few comorbidities.[34,35] Education, motivation and adherence to the procedure by both the patients and accompanying individuals is paramount.[33,34] Patients should be instructed of what the potential postoperative warning signs and symptoms are and who they should contact in case they emerge.[35] There should be no foreseeable complications with the elective procedure.[34] Efficient coordination and communication between the entire team (surgeons, anesthesiologists, nurses, dietitians and physiotherapists) is required.[33] They must have experience and mastery of ambulatory gastrointestinal surgical procedures as well as extensive understanding of the follow-up system, which should be fully outlined.[33,34] The optimal organization model for the early postoperative surveillance should be ascertained for each facility. Considering that after an uncomplicated hospital course patients would have a standard discharge on D3 to D5 and presumably the routine follow-up would only happen 2 to 4 weeks following surgery, daily in-person visits until D10 are probably unnecessary. Notwithstanding, one clinic consultation at D3 to D5 is advisable.[35] Anesthetic management is essential for accomplishing ambulatory colectomy, especially by

preventing/reducing postoperative nausea and vomiting (PONV) and providing analgesic control, which are two of the most common reasons for prolonged hospital stay in the ambulatory setting.[33,34]

- Adrenalectomy

Laparoscopic adrenalectomy is now the main approach since it enables faster recovery and shorter hospital stays compared to open laparotomy.[69] Same-day discharge following laparoscopic adrenalectomy is not broadly practiced, and studies showing its safety and efficacy are limited by single-institution analysis, small sample sizes, extensive exclusion criteria, lack of comparison to the inpatient setting and ambiguous terminology (e.g. including cases of overnight admission with a LOS ≤ 23h, instead of true ambulatory cases).[70–74] In fact, laparoscopic adrenalectomy is included on the 2022 Centers for Medicare and Medicaid Services Inpatient Only List.[75]

Gartland et al. published the first study that directly compared true ambulatory with inpatient minimally invasive adrenalectomies carried out by the same surgeons, in two academic medical centers. It concluded that ambulatory surgery is safe in suitable patients, with no increment of 30-day complications or readmission. The ambulatory group had substantially inferior 30-day complication and readmission proportions, which may have been affected by selection bias and under-reporting of complications, however it is clear that earlier discharge did not lead to increased readmissions. Although no strict eligibility criteria for ambulatory management were used, the probability of ambulatory disposition was higher in the case of lower EBL, earlier surgery completion time and surgery indication being nodule/mass and primary hyperaldosteronism as opposed to pheochromocytoma, Cushing's syndrome and metastasis.[36]

Likewise, Shariq et al. described that ambulatory laparoscopic adrenalectomy was not linked with increased risk of 30-day adverse outcomes when compared to the inpatient setting, using a large, multicenter database of laparoscopic adrenalectomy cases. As such, their study supports the generalizability of Gartland et al. findings beyond the two high-volume endocrine surgery centers. The ambulatory versus inpatient cohorts differed in terms of BMI, ASA score and diagnostic indication, likely since surgeons are more prone admit patients perceived to have higher probability for postoperative complications. The median operative duration was likewise higher in the inpatient cohort, probably as an expected consequence of medical comorbid conditions, case complexity and surgeon experience influencing the decision to postoperatively admit a patient. Therefore, bias toward hospitalization in patients anticipated to experience worse outcomes is a

possibility in this study, however there were no relevant dissimilarities between the ambulatory and inpatient cohorts in terms of 30-day postoperative complications, thus the decision to admit would not have prevented them.[37]

In conclusion, evidence shows that ambulatory adrenalectomy is feasible, even among a wider inclusion cohort, suggesting that despite the importance of considering characteristics that may render early discharge riskier or impractical, the ultimate decision should be based on patient comfort and the discretion of the medical team.[36,37] Nevertheless, Shariq et al. did find ASA class III and obesity to be independent risk factors for both 30-day complications and unexpected readmissions, indicating that these are factors that require attention. They also revealed that primary aldosteronism was protective against 30-day complications, which can be due to the typically small size of the aldosterone-producing adenomas and not being common for these patients to experience perioperative hemodynamic instability. In addition, Shariq et al. reported that a very small percentage (1,8%) of laparoscopic adrenalectomies at the hospitals participating in the database underwent same-day discharge, which may be attributable to a disinclination to same-day discharge due to concerns of missing adverse events, particularly by surgeons at the beginning of their learning curve.[37] In contrast, Gartland et al. described a significantly higher percentage (49%) of ambulatory minimally invasive adrenalectomies, which in all probability illustrates the very specialized nature of their endocrine surgery practice.[36] Additional research is needed to establish the ideal eligibility criteria for this approach, as well as identify barriers to its uptake.[36,37]

Gynecologic surgery

- Myomectomy

Advances in surgical techniques have resulted in myomectomies being increasingly performed using minimally invasive methods, with benefits that include shorter hospital stay and time to return to normal function, fewer adhesions and reduced blood loss and postoperative pain and fevers. Previous studies have demonstrated the safety of same-day discharge after minimally invasive myomectomies, yet normally using small samples and few assessing its feasibility in free-standing ambulatory surgery centers.[38,39]

A 2016 study evaluated the safety and feasibility of discharge on the same day after minimally invasive myomectomy in a relatively healthy population and demonstrated a very low readmission rate and that urgent care or emergency department visits are uncommon, with none of them being

surgical or life-threatening events. Same-day discharge allows for the reduction of health care costs associated with hospital stay and nosocomial infection, without compromising patient care and safety, and can be carried out as a routine practice for uncomplicated cases.[38]

One of the primary concerns with undergoing day-case myomectomies at free-standing surgical centers is the high risk of intraoperative hemorrhage, which is compounded by the lack of blood transfusion capacity and subspecialty support not being usually available. Reversible uterine artery occlusion and permanent uterine artery ligation are nonpharmacological blood loss control techniques which have been reported to decrease EBL, blood transfusions, length of stay and myoma recurrence with no significant effect on fertility. A 2020 study concluded that when certain recommendations are observed, laparoscopic-assisted myomectomy can be safely and effectively conducted at a free-standing ambulatory surgical environment. The surgeon should be skilled and have performed a high-volume of the planned surgical approach. The patient's hemodynamic status should be stable and the preoperative hemoglobin measurement ≥ 9.0 g/dL on the day of the operation. Surgery should be scheduled early in the day and the nurse-patient ratio in the recovery room should be 1:1. Patients with high risk of TED should take home a portable SCD for thromboprophylaxis. Lastly, protocols should be in place to allow immediate transfer to a hospital should serious postoperative complications occur.[39]

- Hysterectomy for malignant disease

Past literature has established that minimally invasive hysterectomy in the ambulatory environment for benign conditions is feasible, without negatively impacting perioperative results and patient's safety. However, the efficacy and safety of same-day after minimally invasive hysterectomy for endometrial and cervical malignancies is undetermined as evidence is more limited and oncology patients are typically older, have more comorbidities and need operations with increased complexity and length, often with concurrent procedures such as lymphadenectomy.[40–42]

Overall, the results obtained show the safety and feasibility of minimally invasive hysterectomy on an ambulatory framework for the treatment of gynecological malignancies.[40-42] Lee et al. findings revealed that patients in the admitted cohort were older, had a greater BMI and more comorbidities compared to those who were discharged on the same day. They were also submitted to more surgically complex procedures compared to the same-day discharge cohort, based on operative and anesthesia times, total relative value units and the performance of

lymphadenectomies, which indicates that physicians considered that the likelihood of complications was higher after more complex surgeries. However, the 30-day postoperative complications rate of those who underwent same-day discharge was equivalent to the rate of those who were admitted, and remained similar when comparing with those that were admitted for one day. This suggests that even though preoperative and intraoperative factors may induce the admission of patients due to more safety concerns, an overnight hospital observation would not have modified postoperative outcomes.[40] Praiss et al. evidence is consistent with these findings, as in select patients same-day discharge did not result in higher risk of perioperative complications or readmissions compared to overnight hospitalization.[41] Data reported by Matern et al. equally supports that same-day discharge is safe, not only in cases of endometrial cancer but also for cervical cancer, as more than 40% of patients had a successful discharge in under 12 hours without a higher risk of readmissions. However, they reported that multiple postoperative complications were not as frequent in the same-day discharge group, such as insufficient pain management, occurrence of VTE and emesis. Older age (> 75 years) was associated with overnight admission, suggesting that this population may not be an optimal candidate for ambulatory hysterectomy. Patients with BMIs between 35-40 kg/m^2 were shown to be more likely to require overnight admission, but not those with BMIs > 40 kg/m^2, making it uncertain whether obesity is a risk factor for admission. The risk for overnight admission was higher in patients whose surgery started after 3 pm compared to those whose surgery started prior to that time, indicating the benefit of scheduling these procedures at the earliest time available. Other variables linked with unsuccessful same-day discharge are uterine mass size and longer operative time. Since patients with advanced disease or cervical cancer are more prone to undergo time-consuming operations, extensive surgical planning and assessing the feasibility of ambulatory treatment in these cases is essential.[42]

Protocols should be developed to facilitate same-day discharge and promote successful outcomes after minimally invasive hysterectomies. Risk stratification models assists in the identification of at-risk patients for adverse outcomes. Additional research is needed to examine risk factors that could be related to extended hospitalization for the purpose of determining which candidates would gain from inpatient observation and monitoring following the procedure. Possible variables that could be evaluated when screening patients for ambulatory hysterectomy include age, history of VTE, uterine size and expected operative time. Scheduling the operation earlier in the day, adequate pain control with limited use of opioids and prevention of PONV are some of the measures that could improve the rates of same-day discharge.[40–42]

Vascular surgery

- Endovascular aneurysm repair

Endovascular aneurysm repair (EVAR) is a minimally invasive procedure that has experienced significant advancements, and it is currently executed more frequently than open surgical repair (OSR) for abdominal aortic aneurysms.[76] Numerous large randomized trials have shown similar long-term survival rates between both methods,[77–79] mostly since EVAR is associated with a significant decrease in perioperative mortality.[80–82] Additional perioperative advantages include decreased length of stay, blood loss, need for transfusions, operative times and intensive care unit admissions.[83]

Considering that relatively large sheaths were traditionally used, the open approach EVAR (OEVAR) was initially required, which entails the surgical exposure of the common femoral artery for its adequate control and manipulation when inserting the graft material.[84] Percutaneous suture-mediated closure devices were posteriorly introduced, enabling the insertion of stent grafts without the need for surgical exposure of the artery (PEVAR).[85,86] Presently, the majority of patients submitted to EVAR are admitted after surgery, but no specific observation period is established and the time of discharge is determined by clinical judgement.[44]

Despite the evidence regarding ambulatory treatment of abdominal aortic aneurysm being limited,[43] recent studies have demonstrated that suitable patients with uneventful operative courses can undergo a safe discharge on postoperative day one, given that early complications are more likely to arise in the immediate postoperative time.[87]

Sousa et al. applied the one day surgery model to the PEVAR management of 19 abdominal aortic aneurysms and 1 common iliac aneurysm, and showed that it is safe and effective if selection criteria are observed. There was only one individual who did not undergo discharge on postoperative day 1, due to a femoral artery pseudoaneurysm diagnosed 6 hours after surgery. The complication rate was minimal, and no readmission, reintervention or mortality from any cause was reported. Adequate selection of patients, use of local anesthesia, ultrasound-guided puncture, preoperative assessment of femoral diameter and an experienced surgical team all contributed to favorable outcomes and minimal morbidity in the ambulatory management of abdominal aortic aneurysm through the PEVAR approach. Literature is conflicting regarding the influence of obesity and calcification of the arterial wall on the technical success of PEVAR,[88] reason why these factors were not included in the exclusion criteria, but Sousa et al. did not find a statistically significant link between calcification of the access artery and the occurrence of complications. The utilization of

ultrasound-guided access, with the detection of a non-calcified arterial area or a better identification of the location of femoral artery in the presence of obesity, assisted in overcoming any limitations resulting from their presence. The one-day surgery model favored the identification of late-onset complications, with subsequent management within the same length of stay, and furthermore prevented readmissions with a possible increase in morbidity.[43]

As for same-day discharge following EVAR, various studies have suggested its feasibility in selected patients, but results were limited by a small sample size, vague preoperative selection criteria and/or lack of complication rates analysis.[89,90]

The study by Hanely et al. was the first prospective research comparing outcomes for selective patients undergoing EVAR on a true ambulatory basis. Approximately 40% of patients in the prospective cohort were candidates for ambulatory EVAR. Same-day EVAR was achieved successfully in 79% of these planned cases, with no increment in perioperative complication, reintervention, readmission or mortality. Predictors of failed same-day discharge were related to operative variables (use of general anesthesia, longer operative duration, greater blood loss and more unplanned operative adjuncts), which indicates that these were surrogates for "eventful" operations. The ambulatory cohort had more visits to the emergency department than the control group, however only one case required readmission and improved preoperative patient education could have prevented most of these visits. In the historical control cohort, nearly 60% of patients met the inclusion criteria, with the 20% difference between both groups indicating that social aspects, which could not be assessed, and surgeon's discretion are significant determinants of the eligibility for same-day discharge.[44]

In conclusion, evidence shows that EVAR for abdominal aortic aneurysms on an ambulatory basis is feasible in selected patients. Complications associated with percutaneous closure mainly develop intraoperatively or within the first hours of surgery.[43,44] However, local late-onset complications, despite rare, are nevertheless possible, frequently result in major complications when not timely recognized and represent a reason for re-admission, therefore serving as a strong motivator for overnight observation.[43] In addition, even though certain intraoperative predictors of unsuccessful same-day discharge have been identified, there are still no preoperative predictors of failure that could be useful in selecting ideal candidates for this approach.[44] For these reasons, a cautionary stance is probably best advised regarding EVAR, particularly with patient selection for same-day discharge, postoperative follow-up protocols and performing this procedure outside the hospital setting.

Logistical factors

It is important to consider social and organizational factors when determining eligibility for ambulatory surgery. Several guidelines in many countries recommend that individuals should have an accompanying adult to escort them to their residence and monitor their recovery for at least one night after discharge.[10,91–93] The escort must comprehend the postprocedural care measures and agree to the responsibility of supervising the patient.[10] Patients should also abstain from driving for at least 24 hours.[10,91] Easy and timely access to emergency care is vital, therefore it is usually recommended that patients' postoperative residence is within an hour's journey from the ambulatory surgery facility or a hospital that can provide it.[10] Language support, including interpretation and translation, should be made available to patients with language barriers.[94] Additional aspects to consider are the home environment and telephone access.[10,91] Even though these recommendations are considered when deciding on ambulatory management, their observation rests on expert advice, and the evidence regarding the impact on ambulatory surgery outcomes is limited.

The prospective study intended to report a descriptive statistical analysis of socioenvironmental variables and their association with postoperative complications, since preceding studies only partially evaluated these factors. Due to the number of adverse events being too low, comparisons between ambulatory patients with and without complications were underpowered, and the effect of socioenvironmental characteristics on outcomes could not be observed. Results did show that some environmental aspects are not always considered after ambulatory surgery, such as absence of an escort when the patient returns home. It is important that patients are escorted home after ambulatory anesthesia and surgery and remain accompanied by a responsible adult for the next 24 hours, as major complications can occur early and require emergency department visits. This was not an interventional study, but rather an observational one, and data showed that 6% of patients were discharge without an escort and 13.7% were alone during the first night after the operation, reflecting failure to schedule an escort or an unforeseen situation where the escort did not show up at the arranged time. Moreover, 3.7% of patients had plans to drive their own vehicle within 24 hours of surgery. In light of this evidence, it is clear that organizational factors were not optimized for all patients. As for the effect of socioenvironmental factors on the results of day surgery, larger-sized studies need to be conducted.[45]

The retrospective study reported that most unplanned admissions after ambulatory surgery happen by virtue of social/organizational and surgical aspects. Several factors predictive of unplanned admission in the study (length of surgery, ASA score and time of operation completion)

could have been prevented in the preoperative evaluation through improved coordination of the operation schedule. To allow for sufficient recovery time and avoid discharge delays, more complex surgeries needing more extended recovery times should be performed earlier. Time of surgery completion past 3 pm is associated with significantly higher risk of hospital admission, indicating that starting the operation after this time should be discouraged or the opening hours of the ambulatory unit prolonged. To sustain the quality of care and lower the costs in the ambulatory setting, measures to avoid unanticipated admissions and delayed discharge are essential.[46]

KEY LEARNING POINTS

1. Age is not a contraindication for ambulatory surgery on its own, and instead a factor that should be integrated with the patient's comorbidities, physiological condition and functional limitation for a careful risk assessment. As such, frailty is a more crucial component of patient selection, and represents an independent risk factor for poor outcomes. The mFI expresses an incomplete overview of frailty, lacking assessment of functional status, cognition and mobility. The RAI incorporates these other important components, including physical, functional, nutritional, social and cognitive aspects. [13–18]
2. The ASA PS classification is a reliable preoperative risk stratifying tool that can be applied in day surgery. Higher ASA PS class is associated with greater morbidity, mortality and hospital admission in the ambulatory setting. In particular, ASA PS IV is associated with a steep increase in mortality risk, therefore inpatient treatment of such cases is the safest option to allow adequate postoperative care.[15]
3. Preoperative screening for OSA is recommended. With optimization of comorbidities and limited use of opioid agents, many at-risk or diagnosed OSA patients can safely undergo ambulatory surgery. In the specific case of airway surgery on an ambulatory basis, additional prospective and multicenter research with larger sample sizes are necessary to determine which candidates are best.[15,21,22]
4. BMI should not be used as a sole factor to exclude patients from an ambulatory approach. Class 1 and 2 obese patients can safely undergo surgery as day-cases, after optimization of any medical comorbid conditions. As for class 3 obese patients, particularly the super morbid obese (BMI ≥ 50 kg/m^2), each case should be evaluated individually.[14,24–29]
5. Both complicated and uncomplicated acute appendicitis can be safely managed in an ambulatory emergency pathway. Appendicolith is a predisposing factor for complicated disease and constitutes an indication for surgical over non-surgical treatment. It is also an independent risk factor for unplanned rehospitalization following surgery, therefore it should elicit closer monitoring and postoperative antibiotic treatment.[31,32]
6. Ambulatory laparoscopic colectomy can be performed without threatening patient safety, if certain conditions are respected. The meticulous selection criteria of patients, excluding those in poor physiological condition and/or with multiple comorbidities, and efficient follow-up protocol for rapid detection of complications are particularly important. Acute complications such as bleeding, anastomotic dehiscence and intestinal obstruction can be detected during the follow-up proceedings and through laboratory testing. Early

postoperative screening for serum CRP is a useful negative predictive test for anastomotic leak.[33–35]

7. Minimally invasive ambulatory adrenalectomy is feasible, but additional research is necessary to establish the ideal eligibility criteria. Primary aldosteronism as indication for surgery is a protective factor against postoperative complications.[36,37]
8. Minimally invasive myomectomy is safe and effective in the ambulatory setting. Reversible uterine artery occlusion and permanent uterine artery ligation are nonpharmacological blood loss control methods that curtail the high risk of intraoperative hemorrhage. Patients should be hemodynamically stable and have a hemoglobin level ≥9.0 g/dL before surgery. A portable SCD should be provided for patients with high risk of TED to take home.[38,39]
9. Same-day discharge is safe after minimally invasive hysterectomy for the treatment of both endometrial and cervical cancer. Possible variables to be considered when selecting day-cases include age, history of VTE, uterine size and expected operative time. Considerable surgical planning and careful assessment of eligibility for day surgery should be given to cases of advanced disease or cervical cancer since they are associated with more lengthy operations.[40–42]
10. Currently, most patients that undergo EVAR are admitted, with no standard observation period. Studies demonstrate that it is feasible as an ambulatory surgery with extended recovery, in selected patients. Local late-onset complications frequently result in major complications when not timely recognized, and despite being rare an overnight observation is advised.[43] In addition, no preoperative predictors of failure have been determined yet, which would be of use for elaborating selection criteria for day surgery. As such, there is not enough evidence to recommend same-day discharge. Ultrasound-guided puncture and preoperative assessment of femoral diameter promote favorable outcomes. Calcification of the access artery is not significantly associated with the occurrence of complications.[43,44]
11. Logistical aspects are a significant reason for unsuccessful same-day, which in certain instances are preventable or modifiable. As an example, more complex surgeries should be scheduled as early as possible, to enable ample recovery time before discharge, and starting a surgery later in the day should be avoided or alternatively the opening hours of the facility extended.[45,46]

CONCLUSION

Several studies have been published assessing the feasibility and safety of the ambulatory approach across multiple subspecialties, revealing promising results. However, there are various labels and definitions for "ambulatory surgery", making it difficult to compare outcomes. Agreeing to interchangeable meanings for "ambulatory surgery" and related terms would therefore be beneficial in research.

The increasing number, diversity and complexity of interventions conducted on an ambulatory basis is mainly possible as a consequence of the advancements of anesthetic and minimally invasive methods registered in the last several decades. As this modality expands and grows around the world, many patients are able to experience the various advantages that it has to offer.

The appropriate patient selection is crucial to ensure safety, promote favorable perioperative outcomes and prevent delayed discharge, unplanned admission, readmission or patient dissatisfaction.

In addition, the success of ambulatory surgery greatly depends upon the experience and training of the multidisciplinary surgical team and the use of tailored surgical and anesthetic techniques. Besides elective surgery, there is also a place for emergency day surgery within carefully planned pathways.

Finally, logistical aspects are usually the most modifiable in order to enable early discharge. It is paramount to take into account the limitations of the each particular ambulatory surgery facility before undertaking any surgical intervention.

Overall, medical reasons, surgical complexity and logistical factors rarely create a barrier to day surgery when the appropriate recommendations are followed. Successful outcomes are achieved when careful patient selection, adequate perioperative management and meticulous follow-up protocols are observed.

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