Factors Contributing to Re-Admission after Elective Day Surgery in a Dedicated Day Surgery Unit

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Abstract

Introduction: Readmission following elective day-case surgery remains an ongoing issue in the NHS. The aim of this study is to determine which factors are associated with an increased likelihood of readmission following elective day-case surgery

Methods: All patients undergoing elective day-case surgery under General Anaesthesia across all surgical specialties at our institution over a 2-year period were included in this study. Data on gender, age, American Society of Anesthesiologists (ASA) grade, smoking status and Body Mass Index (BMI) were analysed.

Results: A total of 4,254 patients with relevant data were identified, of whom 37% (n=1,589) were Male. The vast majority of patients (68.9%, n= 2,930/5,254) had a BMI over 25. Nearly a third (32.3%, n= 1,375) were classified as obese with a BMI over 30. The overall readmission rate was 8.9% (n=379). There was a significant difference with increasing age (>75 years: 13.0%, 15-25 years old: 6.0%, p<0.001). ASA was also associated with a higher readmission rate (ASA 1: 7.0%, ASA>1: 10.1%, p<0.001) however obesity was not (BMI >30: 9.7%, BMI 20-25: 7.9%, p=0.231). There was also no difference in readmission rates based on gender (Male: 9.8% vs Female: 8.4%, p=0.109) and smoking status.

Conclusions: Increasing age, ASA grade and type of surgical procedure are factors associated with a higher readmission rate, obesity itself however is not. Concerns over obese patients undergoing day-case surgery appear to be unjustified as they did not experience a higher rate of admission than the non-obese population.

Keywords: Ambulatory surgery, Readmission, factors.

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Introduction

Hospital inpatient length of stay following surgical procedures has progressively declined over the last two decades due to a host of reasons. The mainstream use of minimally invasive procedures (arthroscopic, ureteroscopic, cystoscopic, hysteroscopic, laparoscopic surgery) has in some ways led to enhanced recovery pathways, permitting earlier discharge. Lack of availability of in-patient beds and perhaps most importantly, the increased use of Day Surgery Units has led to a dramatic reduction in length of stay, allowing hospitals to perform higher volumes of procedures. This, alongside increasing demands placed upon the National Health Service, the role of Day Surgery Units has become even more prevalent from a low of around 7 per cent in 1974 to more recent data from 1998 onwards suggests day cases as a proportion of elective activity have increased from 67 per cent to 78 per cent in 2013 [1]. Patient selection for Day case surgery has been a contentious issue with several different agencies advocating different guidelines based on patient age, comorbidities, complexity of procedure and more recently Body Mass Index (BMI) [2,3].

The United Kingdom has one of the highest rates of obesity worldwide with approximately 25% of adults suffering from Class I Obesity [4,5]. Not only does obesity substantially increase the risk of developing a variety of medical conditions such as Type 2 diabetes, coronary artery disease, hypertension, osteoarthritis and some forms of cancer [6] but they are also at a higher risk of complications following surgery such as wound infections, pain, longer recovery, cardio-respiratory and thrombo-embolic complications [7]. Patients suffering from obesity have been perhaps controversially included by certain guidelines as possibly unsuitable for day-case surgery. However, guidelines are varied in their recommendation as to what BMI or class of obesity is permissible for day-case surgery. For example, the guidelines of the Royal College of Surgeons of England recommend that only patients below a BMI of 30 would be suitable candidates for Day-Surgery whilst the by the United Kingdom's National Health Service (NHS) Modernisation Agency mentions in their guidelines that patients below a BMI of <40 would be suitable. Such varied recommendations within a single country, let alone variations arising across nations and continents are concerning. More recently, these preconceptions (which are not always based on robust evidence) have come under increasing scrutiny and challenge.

Recent guidelines published jointly by the British Association of Day Surgery (BADS) and the Association of Anaesthetists 2019 suggested that day-surgery should be considered as the default position for most surgical procedures and that refusal of patients to undergo day-surgery must be based on sound clinical reasons. As yet, BADS have not set any specific restriction on BMI, however they have suggested that specialists experienced in dealing with obese patients should assess patients with high BMI prior to any day-surgery.

One of the concerns surrounding obese patients undergoing day-surgery is that they may potentially have a higher rate of readmission. Hospital readmissions have been reported to have an adverse effect on healthcare providers in terms of financial and reputational costs as well as patients themselves8. Data from the USA suggests that 20% of patients return to hospital within 30 days of discharge, of which 90% are unplanned admissions with the estimated cost to the extent of US$30 billion [9]. Given that readmissions are a considerable financial burden for hospitals and adverse outcomes for patients, hospital readmissions are increasingly used as quality indicators for institution's performance benchmark with a risk of reduced reimbursements for poorly performing hospitals [10].

To characterise the population of patients who are at risk of readmission following Day-Surgery, we performed a retrospective review of patients readmitted to a dedicated Day-Surgery Unit over

an 9-month period. Specifically, this study aimed to determine what factors namely BMI, ASA grade, smoking, age and co-morbidities are associated with an increased likelihood of readmission following elective day case surgery and whether this can be minimised.

Methods

Data regarding the readmission rates for elective Day Case Surgery from a single centre (St Albans City Hospital) was collected retrospectively over a 9-month period from 01/01/2014 to 31/010/2014. Theatre records detailing information such as operation name, speciality, date, list, patient hospital number, date and time of cancellation, cancellation reason and who by, are entered electronically into a database (Theatreman) by members of staff in real time. An electronic search of this database was carried out to identify re-admissions pan specialty at this centre during the time specified. Due to multiple similar codes for identical reasons for cancellation, these were grouped together for presentation and ease of analysis. The readmission cited were reviewed by the authors. All patients throughout the study period who had a general anaesthetic at the St Albans City Hospital Day Surgical Unit, elective day case procedure across all specialities, and aged 18 years and older were initially included in the study.

A total of 8,096 patients were collated, of those, 6,266 had recorded BMI scores. A further 2012 patients had incomplete/ missing data required (such as demographic data as well as readmission and data on BMI, Smoking, Age, ASA and Co-morbidities), and were thus excluded (Figure 1). Once the cases had been stratified by the NHS treatment function codes, 4,254 cases were viable to analyse and were included in the study. Body Mass Index was grouped into six categories; <20, 20-24, 25-29, 30-34, 35-39, and >40 and case records were examined to determine the number of re-admissions post-operatively. Statistical analysis was carried out to identify factors linked to a higher risk of re-admission. The factors considered were age, sex, BMI, smoking status, American Society of Anesthesiologists (ASA) grade and type of procedure. The number needed to treat (NNT) was calculated to establish how many patients with a BMI of >30 would need to undergo surgery as inpatients rather than day cases to prevent one re-admission.

Exclusion criteria included patients under the age of 18 years, admissions for day-case endoscopy and other LA/sedation procedure including bowel preparation, readmissions for planned interventions (e.g. elective operations, blood transfusion, endoscopy), erroneous discharges on the electronic system and patients who self-discharged against medical advice.

Results

Demographics

A total of 4,254 patients undergoing surgical day case procedures were included in the analysis. These fell within 10 NHS treatment function codes, namely General Surgery, Urology, Breast Surgery, Colorectal Surgery, Trauma & Orthopaedics, ENT, and Gynaecology. Of these 4,254 patients with the relevant data were identified, of whom 37% (n=1,589) were male (Table 1). The 35-44 and 45-54 age groups were the most populous, contributing to 19.7% (n=838) and 19.8% (n=842) of the total population each. The least populous age group was the 75+ age group with 341 patients, accounting for just 8.0% of the total study population. The majority of the population were either overweight or obese and 2.9% (n=124) were underweight (BMI <20). Less than a third (27.9%, n=1,186) had a BMI in the normal range (20-24). Most patients fell in the overweight (BMI 25-29, 27.2%, n=1,155) or Obesity Class I (BMI 30-34, 22.0%, n=938).

Table 1 Population demographics of patients in the study.

			30-day Readmission	
		Total (n)	(n)	%
Gender	Male	1,589	156	9.8%
	Female	2,665	223	8.4%
Age	15-24	355	22	6.2%
	25-34	598	40	6.7%
	35-44	838	68	8.1%
	45-54	842	67	8.0%
	55-64	703	61	8.7%
	65-74	562	61	10.9%
	75+	341	59	17.3%
Current Smoking	Yes	916	64	7.0%
	No	3,279	309	9.4%
ASA	I	1,640	115	7.0%
	II	2,290	233	10.2%
	III	307	30	9.8%
	IV	2	0	0.0%
BMI	<20	138	14	10.1%
	20-24	1,186	94	7.9%
	25-29	1,555	138	8.9%
	30-34	938	91	9.7%
	35-39	352	35	9.9%
	40+	85	7	8.2%

Being a day-case elective surgery unit, the majority of the patients were in the ASA I (38.6%, n= 1,640) and II categories and (53.8%, n=2,057).

Readmission

The overall 30-day readmission rate was 8.9% (n=379/4,254) and analysis demonstrated certain groups of patients to be at higher risk of readmission than others (Figure 2). The most elderly group (75+ year age group) contributed to 13.0% of the readmission, even though they made up just 8.0% of the population. This rate of readmission was much higher compared to the youngest group (15-24 years old) who made up 8.3% of the population but had half the rate of readmission (6.0%, $p<0.001$). Readmission was higher in patients with ASA>1 compared with patients with ASA 1 (ASA 1: 7.0%, ASA>1: 10.1%, $p<0.001$)

Similarly, the type of procedure the patient was undergoing was found to impact on their likelihood of re-admission post-operatively. As a proportion, General Surgery procedures accounted for 17.0% of the day-case workload however, 42.1% of 30-day readmission were after a General Surgical procedure (Figure 3). Notably Gender and smoking did not significantly affect readmission rates (Smokers: 9.4%, Non-Smokers: 7.0%).

Discussion

This study investigated several important factors that could potentially impact re-admission rates following surgical day-case procedures. We examined all the different surgical specialities, BMI, Smoking, Age, ASA and co-morbidities and explored their potential effect on readmission following a day-case procedure in a dedicated hospital. The main factors associated with a higher risk of readmission

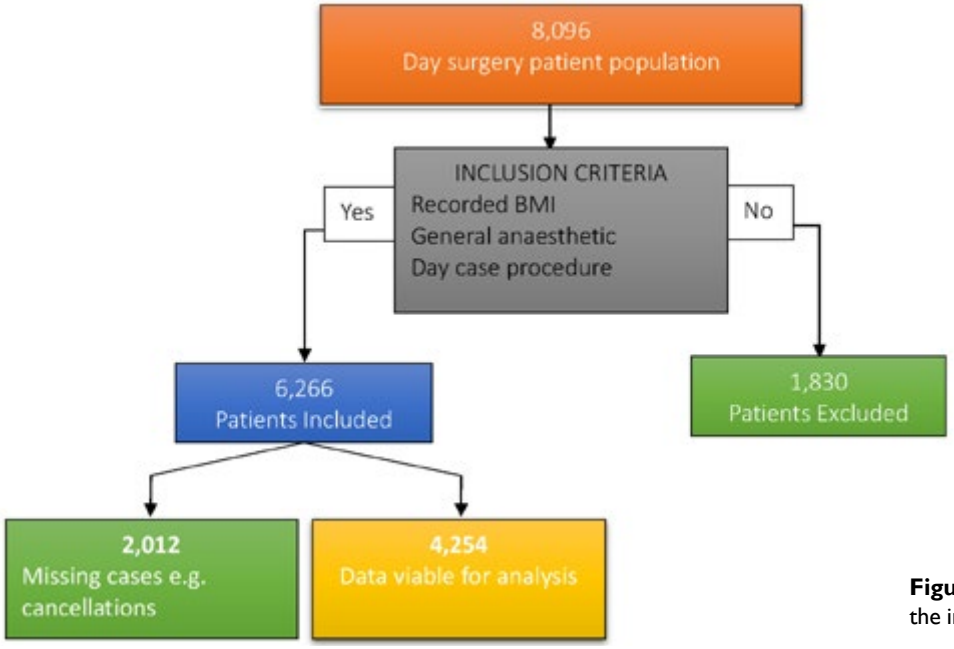

Figure 1 Flow chart demonstrating the included population.

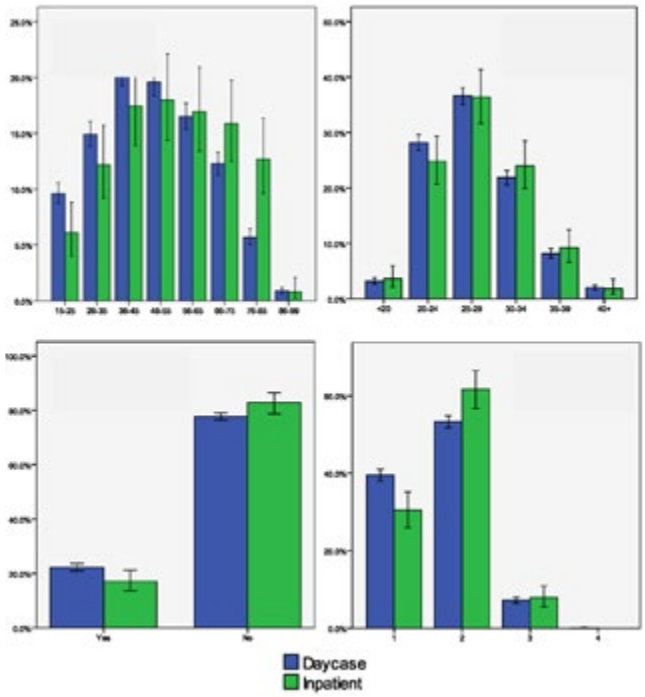

Figure 2 Graphs demonstrating the composition of the population who underwent day-case surrey (labelled 'Daycase') and the population who had a readmission within 30-days of surgery (labelled 'Inpatient').

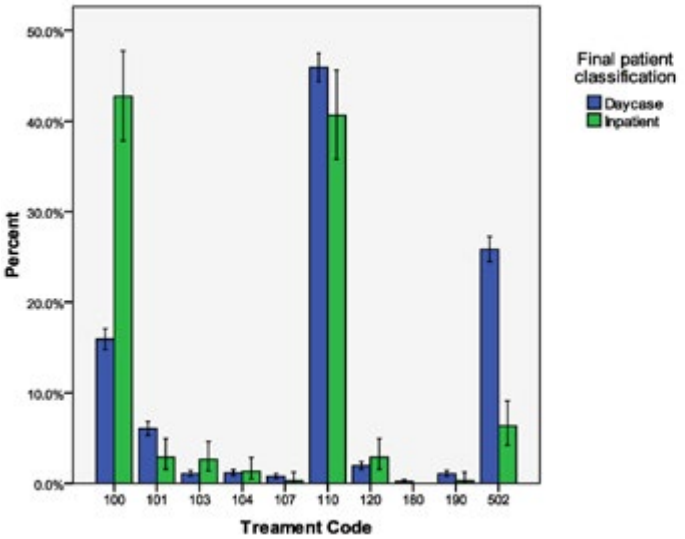

Figure 3 Demonstrating readmission rates according to different surgical specialties. The codes are as following: General Surgery (100), Urology (101), Breast (103), Colorectal (104), Vascular (107), Trauma and Orthopaedics (110), ENT (120), A&E (180), Anaesthetic (190) and Obstetrics & Gynaecology (502).

were advancing age, ASA status and the nature of the procedure. BMI in itself did not significantly impact whether a patient was likely to be readmitted within 30-days of their index day-case procedure. A high BMI is often one of the factors cited to disqualify a patient for day-case surgery in some hospitals. However, in our study (we did not restrict eligibility due to BMI) we did not find that a high BMI significantly increases readmission rates, making the exclusion of patients from day-case surgery based on BMI questionable. Of note, our study found that if we treated all patients with a BMI >30 as an inpatient rather than day-cases, 33 inpatients would be needed to be treated in order to prevent one day-surgery readmission (NNT=33).

Unfortunately, complications are an unpleasant reality of surgery. Over the recent past Day Surgery has become the main resource for a timely throughput and completion of routine cases across all specialities. In such a climate it is imperative that this process is risk averse and safe. Hence, we must have robust policies and procedures in place where patients are made aware and educated on what to expect and do if they require readmission. Patient information sheets, a strict protocol of who to call and where to go should be made available to all patients prior to discharge. Currently, there is no consensus on acceptable readmission rates after day-surgery procedures but rates of 1.1%-10.0% have been suggested as acceptable [11,12]. A Scottish study by Bain and colleagues quoted a readmission rate of 7.8% which is similar to that of the current study [13]. Aside from the index procedure, these variations in readmission rates are dependent on a multitude of factors including, type of specialty, age of patients, level of primary care support and support in the community such as district nurses and other allied healthcare support (dressing clinics, nutritionists, podiatrists). As we continue to push the barriers of what is possible in the day-surgery setting, it could be argued that a readmission rate of under 10% is acceptable. It

is noteworthy that there is a huge difference in the procedures that are currently performed in day-surgery units today than that of 20 years ago. In the absence of any "gold standards" for readmission rates, it is difficult to decide what is an acceptable level of readmissions.

In line with the current study, Kohlnhofer et al collected data on patients undergoing general surgery procedures, as part of an institutional National Surgical Quality Improvement Project (NSQIP) database from 2006 to 2011 [14]. The authors reported that 9% of patients undergoing day-case surgery were readmitted within 30 days after discharge. Similar to the current study, multivariable analysis demonstrated that age, dyspnoea, and ASA grade to be independent risk factors for readmission [12]. Indeed, Lauren et al found that five specialties with the highest number of outpatient surgical procedures were General surgery, orthopaedic, gynaecologic, urologic, and otolaryngologic surgery; their unplanned readmission rates ranged from 1.21% to 3.73% [14].

The current study noted that 8.9% of Day Surgery cases were subsequently readmitted across all specialities with General Surgery being increasingly involved. This was supported in a retrospective study by Coley and colleagues who investigated they looked at the outcome of 20,817 patients who underwent a Day surgery procedure. They found that 5.7% (1,195) of these returned to the hospital within 30 days or were readmitted directly after surgery. Like the current study they also showed that General Surgery procedures had the highest rate of unanticipated admissions or readmissions [15]. More recently, Friedlander in 2019, investigated 73,724 patients who underwent hernia repair, thyroidectomy, laparoscopic cholecystectomy, or laparoscopic appendicectomy in either the inpatient or ambulatory care setting [16]. The vast majority (87%) of procedures were performed in the day-surgery setting. The study reported that readmission rates for thyroidectomy, hernia repair, laparoscopic cholecystectomy were significantly lower in the ambulatory setting compared with the inpatient setting.

Readmissions after elective day-case surgery conjure up a variety of issues for both patients and healthcare providers including personal/social and financial costs for the patient as well as service provision and health economic issues for healthcare providers. However, attempts at tackling the problems of readmission can at times have unintended consequences. The Hospital Readmissions Reduction Program (HRRP) was set up in the USA as part of the Affordable Care Act. It aimed to reduce readmissions after day-case surgery, however after implementation, the 30-day post discharge mortality rose for patients with certain conditions [17,18]. Overall, readmission rates did indeed improve, however given the worsening of other (more important) outcomes, one must question whether readmission in itself is a true and genuine metric of quality healthcare provision and whether more importantly efforts to prevent readmissions compromise patient safety [19]. In the UK a similar scheme to reduce readmissions in the National Health Service (NHS) called 'payment by results' (PBR) was introduced in 2011. Hospitals with high readmission rates were financially penalised such that payments for the initial procedure were withheld. If fully implemented it could have potentially saved the NHS up to half a billion pounds [20].

In recent years, obesity has become a serious healthcare and societal issue, costing the NHS in the UK billions of pounds both directly and indirectly. In our study, 22% of the population suffered from Class I obesity (BMI 30-34), 8% from Class II (BMI 35-39) and 2% from Class III or severe obesity (BMI >40), thus approximately one third of our patients has a BMI if greater than 30. In fact, only a third of patients had a BMI within what is considered to be the normal range (BMI 20-24). Traditionally patients with high BMI have been deemed ineligible for day-case surgery and this has been reflected in local and national guidelines. However, this has been challenged and recently guidelines published jointly by the British Association of Day Surgery (BADS) and the Association of Anaesthetists 2019 suggested that there should be no limitations on high BMI patients undergoing elective day-case surgery based solely on the patient's BMI. In other words, BMI alone is not a reason to prevent overweight or obese patients from having day-case surgery. The only provision is that the specialists who are part of the day-case surgery team should be experienced in dealing with obese patients [21]. Further support that high BMI patients can be safely treated in the Day Surgery setting is provided by Vertosick et al who looked at 13,957 overweight and obese patients undergoing ambulatory cancer surgery procedures and concluded that patients with BMI up to 50 or more can be treated safely in an ambulatory setting [22].

The main limitation of this study is its retrospective nature and as such, suffers from the usual criticisms inherent to such methodology. Data collection from electronic coding database is always problematic in that it relies on the accuracy of the data input in the first instance and the accuracy of its retrieval. There are also issues with the codes themselves, i.e. whether each code accurately reflects that particular patient episode. In our healthcare system, each reason for readmission is coded by a specific code. Unfortunately, more than one code can be used to describe the same reason for readmission and in this study a number of pre-coded reasons for readmission appeared ambiguous as there were multiple similarly worded codes for the same admission reason. Another limitation is the subjectivity of assigning the reasons for readmissions and how related to the initial surgery these readmissions. Other factors to consider would be a more in-depth financial analysis or to consider readmission rates in terms of length of stay and pathology rather than absolute numbers of readmissions. Furthermore, we have not been able to capture all patients that may have been readmitted within 30-days, as inevitably, some patients would attend other hospitals nearby and we would have no knowledge of this readmission. There is no way for us to follow these patients and they have ultimately not been included. A way to capture the entire population is to contact every patient who was initially included in the study and either telephone interview or write to them with a questionnaire. It should be appreciated that in our study a significant proportion of patients were excluded due to missing data. It is also important to remember that only associations can be made between factors and the outcome and not causation.

In the current study we have found that BMI, age and co-morbidities did not have a statistically significant effect on readmission following a Day case procedure in a dedicated unit across all surgical specialities. However, it highlights that the risk of admission after a day-surgery procedure were statistically significant for advanced age (75+ years old), ASA and the nature of the procedure, that is General Surgery procedures were associated with statistically significant higher rates of readmission. In the current study General surgery (excluded Breast, Vascular and Colorectal) included significant numbers of laparoscopic cholecystectomy, laparoscopic hernia repairs and incisional hernia repairs. Notably, a high BMI was not associated with a statistically significant higher rate of readmission and of note the NNT for treating patients with a BMI >30 as inpatients rather than day cases in order to prevent re-admissions were 33. Thus, patients with advancing age and undergoing a General surgery procedure should be counselled about the higher risk of being readmitted and a high BMI in itself should not serve as a basis to refuse day-surgery to patients.

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