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Systematic Review

Day case orthopaedic trauma surgery effectiveness: a systematic review

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ABSTRACT

Day case surgery facilitates effective orthopaedic care for ambulatory trauma cases and can act as an effective pathway in times of reduced resource availability within acute hospitals. A systematic review of the available literature was performed using a narrative synthesis to look for themes underpinning day case trauma practice. A 25 papers were selected from a total of 9956 papers screened to identify those papers that considered day case trauma surgery and its impact on clinical outcome, patient satisfaction and feasibility of delivery within the UK. 9014 patients had day case trauma operations within the 25 papers identified, 86% had general anaesthesia and 14% either regional or local anaesthesia. The mean reported age was 37.5 years with a wide age range (2-83) years treating roughly similar proportions of men and women with a high satisfaction rate when recorded. All areas of the upper limb were operated on apart from the scapula the commonest being the wrist. In the lower limb surgery was undertaken in the knee, ankle or foot with removal of foreign body or ankle fixation being the commonest procedures undertaken. Prevalence of complications at 0.0156% of cases undergoing day case surgery was seen to be lower than in a similar group of inpatient cases. resources are stretched. Day case surgery for trauma procedures within orthopaedics is safe, cost effective and well tolerated by patients. It frees up resources to facilitate treatment and should be utilised within each hospital to enable timely care.

Keywords: Day case, Surgery, Trauma, Orthopaedics

INTRODUCTION

Day case surgery is a well-established way of delivering elective orthopaedic surgical operations safely, cost effectively and has high patient satisfaction.[1-4] Access to dedicated rehabilitation services in dedicated accommodation in America helps day case arthroplasty patients post operatively recover with this type of surgery gaining popularity also in the United Kingdom.[5,6] Day care facilities are less often used to deliver orthopaedic trauma surgery pathways for rapid assessment and patient recruitment can be difficult to coordinate.[7] However, winter pressures and more recently the covid pandemic have seriously limited a surgeon's ability to offer timely surgery.[8,9] Trauma operations must be delivered within a limited time frame after the injury to lead to positive outcomes for rehabilitating the limb. For instance, The British orthopaedic association standards for trauma care (BOAST) indicate that timely surgery for ankle fractures within 24 to 48 hours and intra articular wrist fractures 72 hours (BOAST standard 12 and 13) improves outcome.[10,11] Achieving these targets can be challenging within the resources currently available to hospitals as the population grows and practice evolves.[12,13]

It is not clear how widespread the practice of day case trauma surgery is within orthopaedics in the United

Kingdom, nor the pathways adopted to facilitate treatment, or the list of operations performed although surgery appears confined to the appendicular skeleton more distally.[14] During the recent COVID pandemic more complex trauma cases in the proximal appendicular skeleton such as the humeral shaft or proximal humerus have been undertaken by the senior authors without problems.[15]

The purpose of this study is to establish the range of practice adopted for day case trauma surgery within the UK and to investigate the possible benefits to patients in terms of safety, satisfaction, and convenience by adopting practice available around the world. Also, to evaluate the cost benefits to the NHS and healthcare providers to facilitate development of these pathways especially where resources are limited.

METHODS

The research question was refined using the population intervention comparison outcome study design (PICOS) framework using an iterative approach to consider whether day case trauma surgery improves clinical outcome, patient satisfaction and how feasible is it to implement within the UK.[16]

Search strategy

Eligible studies were found by searching the following databases: Medline, EMBASE, and PsycINFO. All databases were searched up until 10th December 2021. The following search algorithm was adapted for our chosen databases: ("day surgery" or "day case surgery" or "23-hour surgery" or "ambulatory surgery" or "outpatient") and ("Orthopaedic trauma") and ("orthopaedic surgery" or "cost effectiveness" or "patient satisfaction" or "patient reported outcome measures" or "Patient readmission" or "complications" or "length of stay"). The searches were conducted by specialist librarian (within the hospital trust of the lead author) who, while less familiar with the area to research, was skilled at database searches and lists amalgamated. Several iterations were used to maximise sensitivity. In addition to electronic databases reference lists of included studies and relevant reviews were searched to identify missed eligible studies. A "snowballing" method was adopted to include breadth of available literature and contact with study authors to identify any additional or ongoing studies. Additionally, the Royal college of surgeons and British orthopaedic association websites also searched for relevant articles.

Eligibility criteria for study was included in Table 1.

Table 1: Inclusion and exclusion criteria.

Category	Criteria	
	Inclusion	**Exclusion**
Population	Any age	No exclusion
Geography	No limitation	No limitation
Date of search	Dec 10, 2021	
Interventions	Day case / outpatient / ambulatory orthopaedic trauma fracture surgery	Non orthopaedic surgery
Outcomes	Complications, patient satisfaction, cost effectiveness readmission	Studies that do not include at least one of the outcomes listed under the inclusion criteria
Publication language	All	
Study design	Original research, RCTs, case-control studies, studies without a control group retrospective-controlled cohort studies. Prospective controlled cohort studies case series	Case reports
Publication type	Any publication reporting primary data	Publications not reporting primary data. Publications available as abstract only

Study selection

Study screening and data collection process

The details of the searches were recorded systematically with the number of studies excluded at the title, abstract and full text screening stage with reasons (e.g., 'not orthopaedic related' or not in the day case environment) were recorded. Three researchers were involved in the title, abstract and full-text screening stages (DB, JH, NA), and where there was uncertainty in study eligibility, a consensus decision was made by at least two screeners. Endnote was used to capture and manage the references at each stage of screening.

Only full text articles discussing day case trauma surgery, ambulatory trauma surgery or 23-hour trauma surgery were included.

The same three researchers (DB, JH, NA) extracted the study design, participant characteristics (number of participants/ demographics), intervention characteristics (location of intervention, duration, and type of surgery), details of patient complications, and any outcome

measures used such as patient satisfaction (visual analogue score) or assessment score type and value. Finally, any details regarding the cost effectiveness of utilising day case trauma facilities were captured and the rates of readmission and overnight stay.

RESULTS

In total there were 9956 papers identified within the search (1657 Embase, 798 Medline, and Ovid 7501). The number of studies excluded at the title (8457) and abstract screening stage (1231), and numbers of excluded studies with reasons (e.g., 'not orthopaedic related' or not in the day case environment) at the full-text screening stage (140). After exclusion of duplicates there were 31 articles relevant to the research question found, four of these were in a foreign language (only two of these were included, one was excluded because it was a review article, and the other did not focus on day case trauma surgery). Two papers on minimally invasive repair of ruptured Achilles' tendon as a day case procedure with early full weight bearing, Bhattacharya and Gerber and Fixation of clavicle fractures: the role of day surgery? were added from the reference lists.[17,18]

There were three prospective and twenty-two retrospective studies, three of which were propensity matched to ensure that the groups compared had similar characteristics.[19-21] Two studies were prospective with the retrospective controls.

Overall, 9014 patients had day case surgical procedures to treat orthopaedic trauma patients within the 25 papers identified. The type of anaesthesia was recorded in 6 studies. General anaesthesia was used in 1843 patients, regional or local anaesthesia in 308; the type of anaesthesia was not stated in the other papers. The age of patients was reported in 14 studies with a mean of 37.5 years, the range was (2-83) years. In 11 studies the percentage of males ranged from 29.4-89%. Eight studies involved upper limb procedures, 6 lower limb and 4 were mixed. Looking at the range of cases operated on within the appendicular skeleton all areas had surgery within the upper limb from clavicle to digit apart from the scapula. In the lower limb surgery was confined to the knee (patella fixation, arthroscopy, ligament repair) and below.

The most common upper limb operation was wrist plating and the most common lower limb operations was removal of foreign body and ankle fixation.

Overnight stay was required for 28 (0.003%) patients and a readmission rate in 23 (0.003%) other cases within 28 days of surgery.

Clinical outcomes

There were 40 wound infection complications out of 9014 outpatient operations performed (0.004%) although this varied widely in the papers reported (0-9.3%). In-patient (0.2 -1.3%) and outpatient (0-0.7%) prevalence rates were comparable in the two papers that looked at similar patients in different settings.

Other complications were recorded for 142 patients out of 9014 (0.0156%). Again, the prevalence rates seen ranging from 0.6% to 2.0% in outpatients compared to a comparator of 1.6% to 4% in a similar cohort of the inpatients.

The type of complication being similar ranging from wound problems, failure of fixation and thromboembolic events in both groups.

Patient satisfaction

Only one study quantified patient satisfaction with all but 5.3% of trauma patients being satisfied with the process.[2] Two other studies indicated that day case trauma surgery patients showed high satisfaction but there were no figures to describe this in more detail.[2,22]

Bed occupancy and cost savings

A form of cost benefit analysis was carried out in 9 of the 18 studies. Day case trauma surgery led to savings of £294 to £617 per case by avoiding overnight admission.[2,13]

In the US and Canada day case trauma surgery led to savings of $3459 to $5881 per case by avoiding overnight admission.

The total savings of £67450 were reported by Colgate-Stone for 119 upper limb cases and Stull estimated that the health service in the US would reduce costs by $282,529,079.00 if ankle fractures were treated as out-patient or day case trauma procedures rather than being routinely admitted.[13,23]

Five studies (Chandratreya, Bhattacharayya, Howells, Qin, Stull) reported on how day case trauma lists affected bed occupancy. Number of bed days saved ranged from 2.1 to 3.9 per case for 1788 cases. Reducing overnight stays reduces the cost of trauma care and makes more beds available for admission of other patients.[7,11,23-25]

Howells et al showed that 900 bed days per year could be saved by the efficient day case trauma surgery in one unit.[24]

Resources

No studies provided a template for a standard operating procedure needed to underpin safe day case surgery. Suitable pre-assessment and anaesthetic evaluation is required to ensure safe surgery in an adequately equipped facility with a structured follow up and emergency contact numbers in case of patient concerns.

Table 2: Studies included in the literature review.

Authors an d years	Design	Sample size	Age (In years) mean/ range	Male/ female (%)	Upper/ lower limb (%)
Schonauer et al[26] (2001)	Retrospective	101	37 (17-70)	89/11	100% upper
Charalambous et al[12] (2003)	Retrospective	19	25 (17-76)	NR	100% upper
Curtis et al[15] (2004)	Retrospective	22	(17-52)	73/27	100% upper
Chandratreya et al[11] (2006)	Case controlled	53 cases 49 controls	36 (cases) 38.5 (controls)	79/21 cases (controls 76/24)	100% lower
Bhattacharayya et al[7] (2007)	Case controlled	20 cases 20 controls	36.8 (24-48)	NR	100% lower
Howells et al[24] (2009)	Prospective	15	NR	NR	UL 63%, LL 18%, soft tissue 19%
Goel et al[27] (2009)	Observational	27	38.5 (23-58)	81.8/18.2	100% lower
Dillon et al[19] (2009)	Retrospective	87	Median 36 (17-83)	NR	100% upper
Makundan et al[28] (2010)	Retrospective	21	43.4 (26-62)	38.1/61.9	100% lower
Macquet et al[29] (2010)	Retrospective	29	53 (33 - 84)	68/32	100% lower
Colgate Stone[13] et al (2011)	Prospective	119	33 (4-68)	62/38	60 upper/40 lower
Lloyd et al[22] (2012)	Retrospective	816	NR	NR	NR
Qin et al[25] (2016)	Propensity matched cohorts	1633	49.0±16.0	39.1/60.9	100% lower
Mohan et al[30] (2016)	Retrospective	450 (301-day cases)	NR	NR	100% upper
Stull et al[23] (2017)	Retrospective	67	NR	NR	100% lower
Shen et al[31] (2017)	Propensity matched case controlled	2630	43 (31-57)	48.6/51.4	100% lower
Whiting et al[32] (2017)	Propensity matched	2516	74 (62-83)	29.4/70.6	100% upper
Bharma et al[6] (2017)	Retrospective case controlled	105	35 (4-85)	NR	Mixed
Rider et al[33] (2018)	Retrospective	85	4.8 (2-14)	54/46	100% upper
Garon et al[34] (2018)	Retrospective	189	31.2	79/21	100% upper
Athar et al[2] (2019)	Retrospective	229	44.3	55.9/44.1	Mixed
Dayananda et al[16] (2020)	Retrospective/ prospective	431	33.5 (13-67.8)	56.1/43.9	29.4/69.4
Trowbridge et al[35] (2020)	Retrospective	56	46 (20-90)	55.4/44.6	100% upper
Wolfstadt et al[36] (2020)	Retrospective / prospective	277	46.6	43/57	47/ 53
Hockensmith et al[37] (2021)	Retrospective	189	5±2.3 (mean ± SD)	Males 53.9, females 46.1	100% upper

Table 3: Outcome following day case trauma surgery.

Authors	Wound infection, n (%)	Other complications, n (%)	Patient satisfaction (%)	Cost savings	Overnight admission, n (%)	Readmission rate, n (%)
Schonauer et al[26]	7 (6.9)	13 (12.8)	NR	NR	1 (0.9)	1 (0.9)
Charalambous et al[12]	0	0	NR	NR	0	0
Curtis et al[15]	0	0	NR	NR	0	0
Chandratreya et al[11]	0	0	NR	£448 per patient	0	0
Bhattacharayya et al[7]	0	1 (5) (controls 7)	NR	NR	0 in study group	0

Continued.

Authors	Wound infection, n (%)	Other complications, n (%)	Patient satisfaction (%)	Cost savings	Overnight admission, n (%)	Readmission rate, n (%)
Howells et al[24]	0	2	NR	NR	42	NR
Goel et al[27]	1 (3)	1 (9)	NR	$3459 per case	5 (15.2)	0
Dillon et al[19]	4 (4.0)	4 (4.0)	NR	NR	2 (2.2)	0
Makundan et al[28]	1 (4.7)	0	NR	NR	0	0
Macquet et al[29]	1 (3.4)	6 (31.5)	95	significant	0	0
Colgate Stone et al[13]	0	0	NR	£617 per case	0	0
Lloyd et al[22]	0	0	Not quantified	£141428 per annum	NR	0
Qin et al[25]	15 (0.8)	19 (1)	NR	NR	NR	21 (1.1)
Mohan et al[30]	NR	NR	NR	NR	2 (0.7%)	0
Stull et al[23]	0	0	NR	$5881.0 per case	0	0
Shen et al[31]	IP 34 (1.3%)/OP 18 (0.7%)	IP 104 (4%)/ OP 52 (2%)	NR	NR	NR	NR
Whiting et al[32]	IP 0.2% OP 0%	IP 1.6%/OP 0.6%	NR	NR	NR	NR
Bharma et al[6]	0	2 (1.9)	NR	Overall savings £18450	NR	1 (0.95)
Rider et al[33]	1 (1.1)	0	NR	Outpatient surgery quicker and cheaper	NR	NR
Garon et al[34]	7 (3.7)	2 4 (12.7)	NR	Savings $2586.0 per case	N R	NR
Athar et al[2]	0	1 (0.4)	94.5 satisfied	Savings £294 per case	6 (2.6)	0
Dayananda et al[16]	NR	NR	NR	NR	NR	NR
Trowbridge et al[35]	1 (1.8)	6 (10.7)	NR	NR	12 (21.4)	NR
Wolfstadt et al[36]	0	0	high	$100000 CAD annually	0	0
Hockensmith et al[37]	0	0	NR	NR	105	0

DISCUSSION

Major morbidity and mortality following ambulatory surgery is exceedingly low.[38] The government has set targets that 75% of elective surgery should be performed as day cases. Minimally invasive surgery is now well established which has allowed more procedures to be performed as day surgery.[14] Improvements in techniques facilitate reduced surgical time even for quite complex trauma cases including ankle fractures (Bullock et al) or elective surgery enabling procedures such as reverse shoulder replacement (Erickson et al), hip and knee replacements to be done in this setting (Lazic et al).[10,21,39]

Patient selection and consideration of timing for surgery must be robust to facilitate a smooth and safe pathway for patients with those up to ASA III being considered suitable for surgery in this setting (Siow et al). The introduction of BOAST standards for ankle trauma recommending same or next day surgery (Morris et al) has helped reduce the issue of swelling and the need for admission or other interventions to reduce this before surgery (Mahmood et al).[40-42]

In the postoperative period it is important to observe patients to detect the presence of complications which can occur immediately, early or late and be general in nature or specific to the orthopaedic operation (Shin et al). This includes immediate issues such as pain control, nausea and vomiting which often is determined by the nature of the anaesthetic (McCracken et al) and the needs for re-admission for surgical reasons such as swelling,

compartment syndrome and continued bleeding or wound problems early after surgery. This review shows that the complications in patients who had day case trauma surgery did not exceed those in patients who had inpatient trauma surgery. Day case trauma surgery is as safe as inpatient trauma surgery (Crawford et al). With careful selection and appropriate home and healthcare support many trauma cases may be safely managed as day case procedures. Patients awaiting surgery for ankle fractures would only be allowed home if they had home support that would allow them to elevate limb, they required strict elevation, mobilising only for self-care.[14,43,44]

Infection rates in patients treated as day cases were comparable with (Nylen and Roberts) and in some cases lower than those treated as inpatients. Qin et al in comparing ankle fractures treated as inpatients and outpatients showed that surgical complications, superficial and deep surgical site infections as well as wound disruption were less common in outpatients, but the differences were not significant. Whiting had a 0% infection rate, Schonauer had an overall infection rate of 6.9%; the serious infection rate i.e. those who needed admission for intravenous antibiotics was 4%. Comparison of day case and inpatient cohorts showed comparable infection rates; indeed, the infection rate was sometimes lower in those treated as day cases (Qin, Shen and Whiting).[25,26,32,45,46]

Also, the overall complication rates were low, ranging from 0% to 12.8% (Schonauer) and did not exceed those for inpatients in similar studies, (Hargreaves). Comparison of inpatient and day case cohorts showed the day case cohorts had lower total as well as major and minor complication rates (Whiting and Shen).[26,32,47]

Athar et al showed 94.7% satisfaction with day case surgery. Many of the patients treated on day case trauma lists are non-urgent or low priority cases and are often cancelled when placed on inpatient trauma lists; this has been seen frequently in upper limb surgery. It also facilitates the get it right first time objectives by increasing list availability and flexibility to meet the demands of patients (Hind et al). When placed on day case trauma lists, unnecessary hospitalisation is avoided for patients who prefer the streamlined surgical pathways and clear discharge pathways that day case surgery facilitates provide.[2,48]

From the reviews analysed there are clear savings from day case trauma surgery even though the savings vary (Fabricant et al). Estimates of the savings to the NHS vary as the studies span several years; with the increasing tariffs, the increasing cost of healthcare and the greater need to find efficiency savings, the potential cost benefit from day case trauma surgery is even greater. Colgate-Stone showed that their trust saved £67450.00 in one year as a result of day case trauma surgery. Stull estimated that the health service in the US would save $282 million dollars just from treating ankle fractures as outpatients. Imagine the combined total savings that would accrue to the US health service from all outpatient trauma surgery.[13,23,49]

Finally, the recent covid pandemic has focussed surgeons' attention on pathways to improve trauma care in the outpatient setting but also for trauma and elective surgery. Defined green pathways for trauma surgery have facilitated treatment of ambulatory trauma patients.[50-54]

There are several limitations in this review. The studies cover a period of almost 20 years. Analysing cost savings is difficult because of the effect of inflation, changes in demographics of the population, healthcare trends, expectation of patients and demand for surgery. Most of the studies were retrospective. In many cases it was not clear what type of anaesthesia was used or whether it was an upper or lower limb procedure. Some studies stated that day case trauma surgery improved patient satisfaction without quantifying it.

CONCLUSION

Day case orthopaedic trauma surgery when planned is effective, well tolerated and facilitates trauma care when facilities are restricted such as during the COVID outbreak and winter pressures. Every hospital should have a standard operating procedure to facilitate this with a suitably resourced theatre and team available to meet the needs of ambulatory trauma patients.

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REFERENCES

1. Anderson T, Walls M, Canelo R. Day case surgery guidelines. Surgery (Oxford). 2017;35(2):85-91.
2. Athar MS, Fazal MA, Ashwood N, Arealis G, Buchanan D, Okoth FH. Daycase trauma list: a safe and cost-effective service delivery. Ann R Coll Surg Engl. 2019;101:519-22.
3. Ahmed A, Mohamed N, Mohammed H, Islam S, Neil A. Time Frame to Surgery from Presentation of Ankle Fractures and the Impact of the BOAST Standards, do we meet theBOAST Guidelines? J Orthop Bone Disord 2022. J Ortho Bone Disord. 2022;6(4):000228.
4. Aveyard H, Payne SA, Preston NJ. A post-graduate's guide to doing a literature review in health and social care. Oxford: Oxford University Press. 2016;200.
5. Aynardi M, Post Z, Ong A, Orozco F, Sukin DC. Outpatient surgery as a means of cost reduction in total hip arthroplasty: a case-control study. HSS J 2014;10:252.
6. Bharma JS, Dhinsa BS, Davies C, Oliver M. Does a dedicated orthopaedic day surgery list improve delivery of trauma services? J Periop Pract. 2017;27(11):263-7.

7. Bhattacharyya M, Gerber B. Minimally invasive repair of ruptured Achilles tendon as a day case procedure with early full weight bearing. J One-day Surg. 2007;17(3):71-5.
8. BOAST standards. Avaiable at: https://www.boa.ac.uk/standards-guidance/boasts.html. Accessed on 25 June, 2023.
9. Bradley B, Middleton S, Davis N, Williams M, Stocker M, Hockings M et al. Discharge on the day of surgery following unicompartmental knee arthroplasty within the United Kingdom NHS. Bone Joint J. 2017;99-B:788-92.
10. Bullock TS, Gutierrez-Naranjo JM, DelBello RG, Karia RA, Zelle BA. Outpatient surgery in patients with ankle fractures minimises hospital admissions and utilisation of healthcare resources. Int Orthop. 2021;45(9):2395-400.
11. Chandratreya AP, Spalding TJ, Correa R. Development and efficiency of an acute knee trauma list. Injury. 2006;37(6):502-6.
12. Charalambous CP, Zipitis CS, Yarwood S and Hirst P. The development of a protocol in using day surgery for minor orthopaedic trauma patients. Ann R Coll Surg. 2003;85:28-31.
13. Colgate-Stone T, Roslee C, Shetty S, Compson J, Sinha J and Tavakkolizadeh. Audit of trauma case load suitable for day surgery trauma list and cost analysis. Surgeon. 2011;9:241-4.
14. Crawford DC, Li CS, Sprague S, Bhandari M. Clinical and Cost Implications of Inpatient Versus Outpatient Orthopedic Surgeries: A Systematic Review of the Published Literature. Orthop Rev (Pavia). 2015;7(4):6177.
15. Curtis MJ, Samsoon G, Parmar N. Fixation of Clavicle Fractures: The role of day surgery? J One-day Surg. 2004;14(4):89-90.
16. Dayananda KSS, Mercer ST, Agarwal R, Yasin T, Trickett RW. A comparative review of 1,004 orthopaedic trauma patients before and during the COVID-19 pandemic. Bone J Open. 2020;1(8):568-75.
17. Goh GS, D'Amore T, Courtney PM, Hozack WJ, Krueger CA. Total Joint Arthroplasty at a Novel "Hyperspecialty" Ambulatory Surgical Center with Extended Care Suites is as Safe as Inpatient Arthroplasty. Arthroplast Today. 2022;16:242-246.
18. Department of Health. The NHS Plan: a plan for investment. a plan for reform. London: DoH, 2000. Avaiable at: http://webarchive.nationalarchives.gov.uk/+/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4002960. Accessed on 23 Septe, 2023.
19. Dillon CK, Chester DL, Nightingale P, Titley OG. The evolution of a hand day-surgery unit. Ann R Coll Surg Engl. 2009;91(7):559-64.
20. Ding BTK, Decruz J, Kunnasegaran R. Time-sensitive ambulatory orthopaedic soft-tissue surgery paradigms during the COVID-19 pandemic. Int Orthop. 2020;44(8):1531-8.
21. Erickson BJ, Shishani Y, Jones S, Sinclair T, Griffin J, Romeo AA et al. Outpatient vs. inpatient reverse total shoulder arthroplasty: outcomes and complications. J Shoulder Elbow Surg. 2020;29(6):1115-20.
22. Lloyd J, Lockhart J, Sisak K, Middleton R. Acute care: Optimising day of surgery admissions. Health Serv J. 2012;122(6295):28-30.
23. Stull J D, Bhat S B, Kane J M and Raikin S M. Economic Burden of Inpatient Admission of Ankle Fractures. Foot Ankle Int. 2017;38(9):997-1004.
24. Howells N, Tompsett E, Moore A, Hughes A and Livingstone J. Day Surgery for Trauma patients. J One Day Surg. 2009;19(1):23-6.
25. Qin C, Dekker RG, Blough JT, Kadakia AR. Safety and Outcomes of Inpatient Compared with Outpatient Surgical Procedures for Ankle Fractures. J Bone Joint Surg Am. 2016;98(20):1699-705.
26. Schonauer F, Garner JP, Pereira JA, Pickford MA. Introduction of a hand trauma day surgery operating list. Ambul Surg. 2001;9(2):99-102.
27. Goel DP, Chan D, Watson K, Mohtadi N. Safety and hospital costs of Achilles tendon surgery: the serendipitous impact of a randomized clinical trial. Can J Surg. 2009;52(6):467-72.
28. Mukundan C, El Husseiny M, Rayan F, Salim J, Budgen A. "Mini-open" repair of acute tendo Achilles ruptures--the solution? Foot Ankle Surg. 2010;16(3):122-5.
29. Macquet AJ, Christensen RJ, Debenham M, Wyatt M, Panting AL. Open repair of the acutely torn Achilles tendon under local anaesthetic. ANZ J Surg. 2011;81(9):619-23.
30. Mohan A, Thomson RM, Titley G, Chester DL. Ten years of acute hand trauma: is day case surgery still working? A review of 726 patients. Eur J Plast Surg. 2016;39:287-92.
31. Shen MS, Dodd AC, Lakomkin N, Mousavi I, Bulka C, Jahangir AA, Sethi MK. Open treatment of ankle fracture as inpatient increases risk of complication. J Orthop Traumatol. 2017;18(4):431-8.
32. Whiting PS, Rice CD, Avilucea FR, Bulka CM, Shen MS, Obremskey WT et al. Patients at Increased Risk of Major Adverse Events Following Operative Treatment of Distal Radius Fractures: Inpatient versus Outpatient. J Wrist Surg. 2017;6(3):220-26.
33. Rider CM, Hong VY, Westbrooks TJ, Wang J, Sheffer BW, Kelly DM et al. Surgical Treatment of Supracondylar Humeral Fractures in a Freestanding Ambulatory Surgery Center is as Safe as and Faster and More Cost-Effective Than in a Children's Hospital. J Pediatr Orthop. 2018;38(6):e343-8.
34. Garon MT, Massey P, Chen A, Carroll T, Nelson BG, Hollister AM. Cost and Complications of Percutaneous Fixation of Hand Fractures in a Procedure Room Versus the Operating Room. Hand (N Y). 2018;13(4):428-34.
35. Trowbridge S, Wignadasan W, Davenport D, Sarker S, Hunter A, Gidwani S. Is it safe to restart elective day-case surgery? Lessons learned from upper limb

ambulatory trauma during the COVID-19 pandemic. J Clin Orthop Trauma. 2020;11(5):S700-3.
36. Wolfstadt JI, Wayment L, Koyle MA, Backstein DJ, Ward SE. The Development of a Standardized Pathway for Outpatient Ambulatory Fracture Surgery: To Admit or Not to Admit. J Bone Joint Surg Am. 2020;102(2):110-18.
37. Hockensmith LH, Muffly BT, Wattles MR, Snyder EN, McFarland BJ, Jacobs C et al. Evaluating Perioperative Complications Surrounding Supracondylar Humerus Fractures: Expanding Indications for Outpatient Surgery. J Pediatr Orthop. 2021;41(9):e745-9.
38. Shnaider I, Chung F. Outcomes in day surgery. Curr Opin Anaesthesiol. 2006;19(6):622-9.
39. Lazic S, Boughton O, Kellett CF, Kader DF, Villet L, Rivière C. Day-case surgery for total hip and knee replacement: How safe and effective is it? EFORT Open Rev. 2018;3(4):130-5.
40. Siow M, Cuff G, Popovic J, Bosco J. An Evaluation of Patient Risk Factors to Determine Eligibility to Undergo Orthopaedic Surgery in a Freestanding Ambulatory Center A Survey of 4,242 Consecutive Patients. Bull Hosp Jt Dis (2013). 2017;75(3):201-6.
41. Morris DLJ, Fitzpatrick E, Rajan R. Ankle fractures-An audit of BOAST 12 guidelines. J Orthoplast Surg. 2019;2:(2).
42. Mahmood I, Chandler H, Kottam L, Eardley W, Rangan A, Baker P. Neuromuscular Electrostimulation Device Reduces Preoperative Edema and Accelerates Readiness for Theater in Patients Requiring Open Reduction Internal Fixation for Acute Ankle Fracture. Techn Foot Ankle Surg. 2020;19(4):215-9.
43. Shin JJ, Popchak AJ, Musahl V, Irrgang JJ, Lin A. Complications After Arthroscopic Shoulder Surgery: A Review of the American Board of Orthopaedic Surgery Database. J Am Acad Orthop Surg Glob Res Rev. 2018;2(12):e093.
44. McCracken GC, Montgomery J. Postoperative nausea and vomiting after unrestricted clear fluids before day surgery: A retrospective analysis. Eur J Anaesthesiol. 2018;35(5):337-42.
45. Nylén S, Carlsson B. Time factor, infection frequency and quantitative microbiology in hand injuries: a prospective study. Scand J Plast Reconstr Surg. 1980;14(2):185-9.
46. Roberts AH, Teddy PJ. A prospective trial of prophylactic antibiotics in hand lacerations. Br J Surg. 1977;64(6):394-6.
47. Hargreaves DG, Drew SJ, Eckersley R. Kirschner wire pin tract infection rates: a randomised controlled trial between percutaneous and buried wires. J Hand Surg Am. 2004;29(4):374-6.
48. Hind J, Sidhu GAS, Kotecha A, Kitsis C, Ashwood N. Getting it Right First Time in Trauma Clinic: How a Pandemic Improved Service Provision for Orthopaedic Patients. Med Clin Res. 2020;5(9):205-9.
49. Fabricant PD, Seeley MA, Rozell JC, Fieldston E, Flynn JM, Wells LM et al. Cost Savings From Utilization of an Ambulatory Surgery Center for Orthopaedic Day Surgery. J Am Acad Orthop Surg. 2016;24(12):865-71.
50. Megaloikonomos PD, Thaler M, Igoumenou VG, Bonanzinga T, Ostojic M, Couto AF et al. Impact of the COVID-19 pandemic on orthopaedic and trauma surgery training in Europe. Int Orthop. 2020;44(9):1611-9.
51. Elgalli M, Hind J, Lahart I, Sidhu GAS, Athar S, Ashwood N. Outcomes of day case shoulder replacement surgery in a stand-alone day care unit in the United Kingdom. Shoulder Elbow. 2022;0(0).
52. Majholm B, Engbæk J, Bartholdy J, Oerding H, Ahlburg P, Ulrik AM et al. Is day surgery safe? A Danish multicentre study of morbidity after 57,709 day surgery procedures. Acta Anaesthesiol Scand. 2012;56(3):323-31.
53. Westermann RW, Pugely AJ, Ries Z, Amendola A, Martin CT, Gao Y et al. Causes and Predictors of 30-Day Readmission After Shoulder and Knee Arthroscopy: An Analysis of 15,167 Cases. Arthroscopy. 2015;31(6):1035-40.
54. Jiménez Salas B, Ruiz Frontera M, Seral García B, García-Álvarez García F, Jiménez Bernadó A, Albareda Albareda J. Causes of unplanned admission after orthopedic procedures in ambulatory surgery. Rev Esp Cir Ortop Traumatol (Engl Ed). 2020;64(1):50-56.

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