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Evaluating the Necessity of Routine Blood Type and Screen Testing Prior to Appendicectomy

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Abstract

Aim

Appendicectomy is one of the most common emergency surgeries and is typically associated with minimal blood loss. Despite this, many institutions require routine preoperative type and screening (T&S) prior to appendicectomy. This study aimed to determine the rate of transfusion in appendicectomy.

Methods

Audit approval was obtained (250907). Data was collected retrospectively from health records of all patients who underwent appendicectomy at Connolly Hospital, Ireland, between January 2023 and December 2024.

Results

In total, 340 patients were included. The median age was 35.0 years [IQR; 22.3, range: 16 – 84], with 46% female (157). The majority of cases were emergency (330, 97%) and laparoscopic (339, 99%). A preoperative T&S was sent in 320 patients (94%) and 10 patients (3%) were crossmatched. The rate of intraoperative transfusion was 0% and only 1 patient (0.3%) required a postoperative blood transfusion. Haemoglobin was significantly lower in the crossmatched group (mean haemoglobin 12.5 g/dL [SD: 0.83], p = 0.007). The estimated cost per T&S was €54.52, equating to a total of approximately €17,446.40 for the study period.

IMJ
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Original Paper

Discussion
The incidence of perioperative transfusion during appendicectomy is extremely low. A selective, risk-based approach – targeting patients with complicated appendicitis or pre-existing anaemia – may safely reduce costs without compromising patient care.

Introduction

Acute appendicitis is among the most common indication for emergency abdominal surgery internationally[1]. Timely surgical intervention remains the standard of care[2-5] and is thought to reduce complications such as perforation, gangrene, and peritonitis. The 2020 Jerusalem guidelines, recommend that patients with uncomplicated appendicitis undergo surgery within 12-hours of diagnosis[6, 7]. Preoperative type and screen (T&S) testing, also known as group and save, is a well-established component of preoperative planning in many surgical units. The purpose being to identify the patient's blood group and screen for clinically significant alloantibodies, thereby ensuring that compatible, type specific, blood for transfusion can be provided without delay in the event of haemorrhage[8, 9]. The time to obtaining crossmatched blood varies from institution but is reduced if a valid T&S sample is available. In our institution, assuming there are no grouping or antibody abnormalities, crossmatched blood products can be made available in just ten-minutes if two valid T&S samples are available, extending to forty minutes if the T&S sample is received for the first time with the crossmatch request.

However, with advances in minimally invasive surgery and improvements in anaesthetic and haemostatic techniques, the frequency of blood transfusion in laparoscopic appendicectomy, has declined. Laparoscopic appendicectomy is typically associated with minimal blood loss, of an average of less than 50ml per patient, and transfusion requirements are generally low[9-13]. Additionally, from a health economics perspective, routine preoperative T&S carries a measurable financial burden. Each test incurs laboratory processing costs, staff time, and consumables. Unnecessary T&S requests can therefore increase laboratory workload, delay theatre start time and incur additional costs perhaps without clinical benefit. Many international guidelines now support judicious use of T&S, limiting it to patients or procedures with a higher risk of intraoperative transfusion[14]. Nevertheless, the practice persists in many hospitals, often as part of a standard preoperative protocol.

The aim of this study was to determine the rate of blood transfusion among patients undergoing appendicectomy, to evaluate whether routine preoperative T&S is justified.

IMJ
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Original Paper

Methods

A retrospective single-centre analysis was performed at Connolly Hospital, Blanchardstown, Ireland. Audit approval for collection and processing of data was obtained from the institution's local audit committee, 250907. All patients who underwent appendicectomy between 1st January 2023 to 31st December 2024 were evaluated. Inclusion criteria included: patients of any sex, over 16 years of age, who underwent appendicectomy whether open or laparoscopic and regardless of indication. Both elective and emergency operations were included.

Data was obtained from electronic theatre management system and health records. Demographic and clinical data were collated electronically, including age at admission, sex, date and time of admission, date and time of discharge, intraoperative details, American Society of Anaesthesiologists (ASA) grade[15], perioperative haematological and biochemical results, histological results, and lastly, whether a perioperative T&S or crossmatch was obtained and/ or whether a perioperative transfusion occurred. Where ASA grade was not available it was not inferred. Patients were considered anaemic if haemoglobin was less than 13.5g/dL for males and less than 12.0g/dL for females 16. Histologically confirmed appendicitis was not necessary for inclusion, though histology was systemically reviewed and is reported upon. The per unit cost of a single T&S was obtained from our local blood transfusion laboratory. No additional correction was made for out-of-hours staff cost or need to repeat testing due to sampling error etc.

Descriptive statistics were used to summarise basic demographics and clinical outcomes. Continuous variables were reported as means with standard deviations (SD) and medians with interquartile range (IQR). Categorical variables were expressed as frequencies and percentages. Analysis was performed using Fisher's exact test or Mann Whitney U depending on data type. Given the extremely low transfusion rate, of only 1 patient, no formal statistical comparison between transfused and non-transfused patients was possible. All analyses were conducted using version 2.6 of Jamovi (The Jamovi project, Sydney, Australia).

Results

Patient demographics and operative details

A total of 340 patients underwent appendicectomy during the study period. The median age was 35.0 years [IQR; 22.3, range: 16 – 84], 157 (46%) of whom were female. Most procedures were performed as emergency operations (330, 97%). The majority of patients with a documented ASA grade had an ASA 1 or 2 (198, 58%), however ASA grade was not recorded for the majority cases. One patient underwent open appendicectomy, with the majority

performed laparoscopically (339, 99%). Mean haemoglobin preoperatively was 13.7 g/dL (SD: 1.52). Of note, only 7 patients (2%) did not have haemoglobin testing preoperatively, however, postoperatively 136 patients (40%) did not. Mean length of stay was 3 days (SD: 3.0). *Table 1* further summarises demographic and operative details.

Histology

Histology was acute appendicitis, in emergency cases, or normal, in elective cases, in 326 patients (96%), 10 patients (3%) had a normal appendix despite the indication for surgery being acute appendicitis, of these, one patient had histologically confirmed Meckle's diverticulitis. In total, 4 patients (1%) had a confirmed neoplastic process in the appendix, all of which were grade 1. *Table 1* further summarises histological results.

Type and Screen testing

A preoperative T&S was performed in 320 patients (94%) of all cases. The remaining 20 patients (6%) proceeded to surgery without a T&S. There was no significant difference in age, sex, admission type, ASA grade between those who did and did not undergo T&S testing. Preoperative haemoglobin and c-reactive protein were similar between groups. Mean haemoglobin was 13.7 g/dL [SD: 1.54] and 14.0 g/dL [SD: 1.22] for the T&S and no-T&S group, which was not statistically significant (p = 0.330). Similarly, mean c-reactive protein was 71.8 g/dL [SD: 82.06] and 59.1 [SD: 72.34] for the T&S and no-T&S group, which was not statistically significant (p = 0.364). Interestingly, mean white cell count was significantly lower in the T&S group than in the no-T&S group (11.7 $x10^9$/L [SD: 4.97] vs 14.0 [SD: 4.01], p = 0.018) although this did not translate to higher crossmatching rates. Overall, haemoglobin and inflammatory markers were not predictors of whether T&S was obtained preoperatively or not. Table 2 further summarises T&S testing groups.

Crossmatching and transfusion rates

A total of 10 patients (3%) underwent preoperative crossmatching. There were no significant differences between crossmatched and non-crossmatched patients with respect to age, sex, admission type, or ASA grade. Preoperative inflammatory markers (white cell count and c-reactive protein) was also similar between the two groups (mean white cell count, 10.4 $x10^9$/L [SD: 4.1] vs 11.8 [SD: 4.9], p = 0.411 and mean c-reactive protein, 110.7 g/dL [SD: 109] vs 69.8 g/dL [SD: 80.3], p = 0.119). However, patients who were crossmatched had significantly lower preoperative haemoglobin levels compared with those who were not crossmatched (mean

haemoglobin 12.5 g/dL [SD: 0.83] vs 13.7 g/dL [SD: 1.5], p = 0.007). Table 3 further summarises cross match testing groups. Intraoperative transfusion rate was 0%. Only one patient (0.3%) required a postoperative blood transfusion. This case involved the planned administration of a single unit of packed red cells in the postoperative period for symptomatic anaemia, rather than for intraoperative haemorrhage. No patients required emergency transfusion, and there were no adverse transfusion-related events.

Cost implication

Each T&S costs approximately €54.52 to obtain and process. Over the study period, the total expenditure on T&S for appendicectomy patients amounted to approximately €17,446.40. Eliminating routine T&S in low-risk appendicectomy cases could therefore yield significant savings, both financially and in terms of laboratory workload, while maintaining patient safety. Additionally of note, the cost per T&S extends beyond laboratory cost alone and includes less easily quantifiable costs, including phlebotomy, nursing/medical time, portering, and technological costs not fully reflected here.

Discussion

This study provides an evaluation of preoperative T&S testing amongst patients undergoing appendicectomy in an Irish hospital. Our findings demonstrate an exceptionally low incidence of perioperative transfusion, with no instances of intraoperative transfusion and only a single postoperative transfusion across 340 appendectomies performed over a two-year period. It is also worth noting also that the transfusion was planned, non-emergent, and administered for symptomatic anaemia in a haemodynamically stable patient. Despite this, T&S testing was obtained in 94% of patients, and crossmatching occurred in 3%, indicating that routine T&S testing remains part of the preoperative assessment for appendicectomy within our institution. These findings suggest that the current practice of T&S for all may not be justified.

Routine preoperative T&S has historically been justified by the perceived need to promptly provide compatible blood in the event of intraoperative haemorrhage. Additionally, the practice is further rationalised by the time delay in obtaining group specific crossmatched blood products if no valid T&S sample is held. In our institution, crossmatched products are available in just ten-minutes if two valid T&S samples are available. If, however, the crossmatched products are requested along with a first a T&S sample, it will take approximately forty minutes for the products to be made available. However, laparoscopic appendicectomy is associated with minimal blood loss, typically under 50 mL, and consequently very low transfusion rates[9-12]. The findings of this study align strongly with the

existing literature, reaffirming that the probability of transfusion in this cohort is negligible[9-12, 17, 18].

While the purpose of obtaining preoperative T&S testing is to ensure preparedness for rare complications, the financial and logistical implications can be substantial[18]. Each T&S request consumes laboratory time, resources, and reagents, and when multiplied across the various cases annually, this results in considerable, and potentially, avoidable expenditure. Although the per-test cost may be modest, the aggregate expenditure associated with widespread, low-value testing can be substantial. Judicious use of resources, with patient safety at the core, is paramount. As illustrated in this study, avoiding T&S and crossmatching in this cohort could have produced savings of over €17,000 over a two-year period, without any patient safety implications. Although the cost of an individual test is relatively low, the large volume of surgeries performed each year results in a considerable cumulative financial burden. Furthermore, unnecessary testing may delay theatre start times and increase administrative workload without improving patient outcomes. Selective testing based on clinical and operative risk factors offers a more rational alternative. Patients with complicated appendicitis, preoperative anaemia, and/ or anticoagulant use may warrant a preoperative T&S, whereas otherwise healthy individuals undergoing laparoscopic appendicectomy are unlikely to benefit.

Adopting such a stratified approach could optimise resource utilisation while maintaining safety. If such limits are placed on T&S testing the institution should ensure the easy availability of blood for transfusion in the event of major haemorrhage. In emergencies, rapid administration of O-negative blood provides an effective means of stabilising haemodynamically compromised patients if necessary. Additionally, patients with significant pre-existing anaemia, known haematological disorders, anticoagulant therapy, or suspected complicated appendicitis may warrant selective T&S testing, as these groups may be at higher risk of transfusion in the event of operative complications. A targeted T&S protocol focused on such higher-risk cases may therefore represent a more rational use of resources without compromising patient safety.

This study is limited by its retrospective design and single-centre setting, which may restrict generalisability. The audit relied on electronic records and certain data omissions are possible, as such, factors which may increase the risk of transfusion, such as anticoagulation use or co-morbidities, were not systematically examined. The single centre setting also limits generalisability, particularly to centres with different transfusion practices, laboratory response times, or surgical case mix. A further limitation lies in the low event rate itself. While the negligible transfusion rate reinforces the argument that routine T&S is unnecessary, it also precludes sophisticated multivariable modelling or predictive analytics. Nonetheless, the consistency of findings with existing literature supports the validity of the conclusion[9-12, 17, 18].

IMJ
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28th September, 2026
Original Paper

Nonetheless, the consistency of our findings with the wider body of international literature strengthens the validity of our conclusions. Further work in this area includes multicentre evaluation of T&S necessity for those undergoing appendicectomy, and prospective evaluation of the true cost per test.

Perioperative transfusion during appendicectomy is exceedingly rare, yet routine preoperative T&S testing remains common. A more selective, risk-based approach to preoperative blood testing warrants further study as this may safely reduce unnecessary costs and improve efficiency. This study demonstrates that patients undergoing laparoscopic appendicectomy rarely require transfusion. With appropriate safeguards, including the availability of emergency uncrossmatched blood, a risk-stratified approach is likely both safe and efficient. Selective T&S testing based on risk, with rapid availability of universal blood for transfusion if necessary, may represent a more clinically and financially prudent approach.

Declarations of Conflicts of Interest:
None declared.

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IMJ
Official Journal of the Irish Medical Organisation

Ir Med J; September 2026; Vol 119; No. 8; P159
28th September, 2026
Original Paper

Tables

Table 1 *– Demographic and operative details*

	n = 340
Sex	
Female	157 (46%)
Male	183 (54%)
Age (median (IQR, range)), years	35.0 (22.3, 16 - 84)
Admission type	
Emergency	330 (97%)
Elective	10 (3%)
ASA	
1	96 (28%)
2	97 (29%)
3	5 (1%)
Not recorded	142 (42%)
Operation type	
Laparoscopic	339 (99.7%)
Open	1 (0.3%)
Blood parameters	
Pre-op Hb (mean (SD, range)), g/dL. Not sent	13.7 (1.52, 8.7-16.8). 7
Pre-op WCC (mean (SD, range)), 10^9/L. Not sent	11.8 (4.94, 2.5-31.0). 7
Pre-op c-reactive protein (mean (SD, range)), mg/L. Not sent	74.1 (81.86, 0.6-431.7). 22
Post-op Hb (mean (SD, range)), g/dL. Not sent	12.3 (1.48, 8.3-17.3). 136
Anaemia	
Females	43 (27% of females)
Males	32 (17% of males)
Preoperative wait time (mean (SD)), days	0.5 (0.7)
Duration of operation (mean (SD)), minutes	77.9 (28.4)
Length of stay (mean (SD)), days	3 (3.0)
Histology	
Acute appendicitis/ normal *	326 (96%)
Negative appendicectomy	10 (3%)
Neoplastic	4 (1%)
T&S testing pre-op	
Obtained	320 (94%)
Not obtained	20 (6%)
Units cross matched	
0	330 (97%)
1	7 (2%)
2	3 (1%)
Units transfused	
0	339 (99.7%)
1	1 (0.3%)

SD, standard deviation; ASA, American Society of Anesthesiologists; Pre-op, preoperative; Hb, haemoglobin; WCC, white cell count; T&S, type and screen
*Histology was normal in cases of elective appendicectomy

Table 2 – *T&S vs no-T&S comparison*

	T&S sent	**T&S not sent**	**p-value**
Age (median)	35.0 years	28.5 years	0.329 **
Sex			
F	146	11	0.491 *
M	174	9	
Admission type			1.000 *
Elective	10	0	
Emergency	310	20	
ASA			
1	91	5	0.742 *
≥2	98	4	
Anaemia			
No anaemia	239	19	0.055 *
Anaemia	74	1	
Hb (mean (SD, range)), g/dL	13.7 (1.54, 8.7-16.8)	14.0 (1.22, 11.6-15.9)	0.330 **
WCC (mean (SD, range)), 10^9/L	11.7 (4.97, 2.5 – 31.0)	14.0 (4.01, 4.3 – 19.4)	***0.018 *****
CRP (mean, (SD, range)), mg/L	71.8 (82.06, 0.6 – 431.7)	59.1 (72.34, 0.6 – 230.2)	0.364 **

F, female; M, male; ASA, American Society of Anaesthesiologists; Hb, haemoglobin; WCC, white cell count; CRP, c-reactive protein
*, Fisher's exact test
**, Mann Whitney-U test

IMJ
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28th September, 2026
Original Paper

Table 3 *– Crossmatch vs no-crossmatch comparison*

	Crossmatched	**Not crossmatched**	**p-value**
Age (median)	40.0 years	34.0 years	0.132 **
Sex			
F	7	150	0.197 *
M	3	180	
Admission type			1.000 *
Elective	0	10	
Emergency	10	320	
ASA			0.120 *
1	1	95	
≥2	6	96	
Anaemia			
No anaemia	7	251	0.700 *
Anaemia	3	72	
Hb (mean (SD, range)), g/dL	12.5 (0.83, 11.2 – 13.7)	13.7 (1.5, 8.7 – 16.8)	***0.007 *****
WCC (mean (SD, range)), 10^9/L	10.4 (4.1, 4.3 – 16.8)	11.8 (4.9, 2.5 – 31.0)	0.411 **
CRP (mean, (SD, range)), mg/L	110.7 (109, 3.7 – 338.8)	69.8 (80.3, 0.6 – 431.7)	0.119 **

F, female; M, male; ASA, American Society of Anesthesiologists; Hb, haemoglobin; WCC, white cell count; CRP, c-reactive protein
*, Fisher's exact test
**, Mann Whitney-U test