

# A Retrospective Analysis of the Clinical Utility and Cost-Effectiveness of Routine Preoperative Blood Grouping and Saving Protocols in Patients Undergoing Laparoscopic Surgical Procedures

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## Abstract

**Introduction:** In patients undergoing elective laparoscopic cholecystectomy or appendicectomy, standard preoperative practice often includes blood grouping and saving (G&S). Notwithstanding the infrequent requirement for blood transfusion during these procedures, the procurement and laboratory analysis of G&S specimens impose a cost of £31 (approximately \$40) per sample. This investigation seeks to evaluate blood transfusion utilization in these surgical cohorts to ascertain the clinical justification for routine G&S sampling versus its potential as a dispensable expenditure. **Methods:** A retrospective review of patient records was performed for individuals who underwent laparoscopic cholecystectomy or laparoscopic appendicectomy between January 2023 and June 2024. The data extracted comprised the timing of (G&S) procedures, preoperative and postoperative haemoglobin concentrations, the timing of any blood transfusions administered, and the total number of blood units transfused. **Results:** A total of 310 patients participated in this investigation. Within the laparoscopic cholecystectomy cohort (n=164), 129 individuals (78.65%) underwent preoperative grouping and screening (G&S) for blood compatibility. In the laparoscopic appendicectomy group (n=146), 95 patients (65.06%) received preoperative G&S. It is noteworthy that no patient within the entire cohort of 310 required a blood transfusion within the 30-day postoperative period. **Conclusions:** The results indicate that routine Group and Save (G&S) blood sampling does not represent a clinically necessary expenditure for patients undergoing elective laparoscopic appendectomy or cholecystectomy. To optimize resource allocation and minimize non-essential costs, it is advised that G&S sampling be selectively employed in patient populations identified as being at elevated risk for perioperative complications requiring blood transfusion.

**Keywords:** *laparoscopy, laparoscopic cholecystectomy, blood transfusion, blood group and save, laparoscopic appendicectomy.*

## Introduction

Laparoscopic cholecystectomy, performed approximately 69,000 times annually, and laparoscopic appendicectomy, with roughly 44,000 procedures per year, represents two of the most frequently executed fundamental laparoscopic interventions within general surgery <sup>[1]</sup>. Laparoscopic cholecystectomy is the established gold standard for the management of the majority of gallbladder pathologies, encompassing cholelithiasis and gallbladder polyps. Analogously, laparoscopic appendicectomy has achieved considerable prevalence over the preceding two decades for the treatment of appendicitis, exceeding the utilization of open surgical approaches <sup>[2-4]</sup>.

In laparoscopic cholecystectomy, the cystic artery and the gallbladder bed represent the primary sources of intraoperative hemorrhage, and these are generally amenable to laparoscopic management. Similarly, during laparoscopic appendicectomy, bleeding typically originates from the appendicular artery within the mesoappendix and is usually controllable laparoscopically. While

rare, uncontrollable haemorrhage from retroperitoneal vessels can occur during laparoscopic appendicectomy. Furthermore, major vascular injuries, although infrequent (with reported incidences of 0.07-0.11%), can arise during the establishment of pneumoperitoneum <sup>[5-7]</sup>.

Recent progress in laparoscopic instrumentation, surgical techniques, and surgeon training has significantly enhanced the safety profile of fundamental laparoscopic procedures, resulting in minimal intraoperative blood loss. Consequently, the requirement for blood transfusions has become exceptionally infrequent, with contemporary intraoperative and postoperative transfusion rates reported for laparoscopic cholecystectomy ranging from 0% to 1.4% in the literature <sup>[7-10]</sup>.

ABO and RhD antigen typing establish a patient's blood group, and reserving the sample facilitates subsequent cross-matching procedures, which are essential for pre-transfusion antibody detection. This practice, historically termed "group and save" (G&S), was a standard component of preoperative assessment during the era of open surgical procedures. Despite contemporary

evidence indicating a minimal incidence of intraoperative and postoperative blood transfusions, G&S continues to be routinely performed preoperatively for a substantial proportion of abdominal surgeries, including minimally invasive procedures such as laparoscopic cholecystectomy and appendectomy [9-11]. This study aimed to examine the frequency of perioperative blood transfusions and perform a cost analysis of G&S samples collected prior to laparoscopic cholecystectomy and appendectomies.

## Materials and Methods

This retrospective cross-sectional investigation, conducted at a tertiary care hospital aimed to assess the utility of "Group and Save" (G&S) blood samples in patients undergoing either laparoscopic cholecystectomy or laparoscopic appendectomy. The patient cohort was identified through the hospital's information department using Office of Population Censuses and Surveys (OPCS) coding for procedures performed between January 1, 2023, and June 30, 2024. Approval for this study was granted by the hospital's clinical governance department, and the requirement for individual written informed consent was waived on the basis of its design as a quality improvement audit.

All laparoscopic appendectomies were conducted as emergent procedures. Of the cholecystectomies, 104 (63.41%) were performed on an emergency basis, while 60 (36.58%) were elective. Patient identification was facilitated through the institution's electronic surgical theater database. A meticulous review of each patient's electronic health record, utilizing the hospital's eCARE software (Cerner Works), was performed to ascertain the quantity and temporal sequence of blood samples submitted for (G&S) testing, as well as any blood product transfusions administered. This

retrospective review encompassed patient demographics, pre-existing comorbidities, and anticoagulant medication usage to establish a comprehensive characterization of the patient cohort and their associated clinical requirements.

All patients meeting the inclusion criteria were incorporated into the analysis without any exclusion, thereby ensuring a complete and unbiased evaluation of the dataset. The meticulous review of patient medical records facilitated a precise determination of the utilization and clinical necessity of (G&S) blood samples in the context of these surgical procedures.

To evaluate the economic and time-related implications of the (G&S) process, the study additionally collected data concerning the cost and estimated time expenditure incurred by the hospital's transfusion service. This information was critical for assessing the efficiency and resource allocation associated with G&S blood samples within the context of laparoscopic surgical procedures.

The overarching objective of this investigation was to generate clinically significant data regarding current practices in Group and Screen (G&S) blood sampling during laparoscopic surgical procedures, with the ultimate aim of refining existing clinical protocols and optimizing resource allocation within the institution.

## Results

### Patient demographics

Over the study duration, 146 patients underwent laparoscopic appendectomy, and 164 patients underwent laparoscopic cholecystectomy. The demographic characteristics of the patient cohort are presented in Table 1.

**Table1: Patient demographics**

Demographics	Laparoscopic cholecystectomy (n=164)	Laparoscopic appendectomy (n=146)
Meanage	50	32.2
Sex ratio(F:M)	1.2:0.8	1.4:0.6
ASA score		
1	35 (21.34%)	76 (52.05%)
2	110(67.07%)	62(42.46%)
3	11 (6.7%)	4 (2.73%)
4	1(0.6%)	0(0%)
Anticoagulant use	7(4.26%)	4 (2.73%)

### ASA: American Society of Anaesthesiologists

A retrospective analysis of 146 patients undergoing laparoscopic appendectomy revealed a mean age of 32.2 years, with a female preponderance indicated by a female-to-male ratio of 1.4:0.6. Preoperative blood grouping and screening (G&S) was performed

once for 107 patients (65.24%), twice for 24 patients (14.63%), and cross-matching was necessary for 3 patients (1.82%). All appendectomies were conducted on an emergency basis, and no patients required blood transfusions either during the surgical procedure or in the immediate postoperative period (Table 2).

**Table2: Preoperative G&S and Transfusion Rate**

Procedure	No	1 G&S (%)	2 G & S (%)	Cross-match (%)	Transfusion (%)
Laparoscopic appendectomy	146	107 (65.24%)	24 (14.63%)	3 (1.82%)	0 (0%)
Laparoscopic cholecystectomy	146	106 (72.60%)	21 (14.38%)	5 (3.42%)	0 (0%)

### G&S: group and save

A study investigating laparoscopic cholecystectomy procedures reported a mean patient age of 50 years, with a female preponderance indicated by a female-to-male ratio of 1.2:0.8. The study cohort of 164 patients comprised 104 individuals (63.41%) undergoing emergency cholecystectomy and 60 individuals

(36.58%) undergoing elective procedures. Preoperative blood sampling revealed that 107 patients (65.24%) had a single group and save sample collected, 21 patients (14.38%) had two group and save samples, and 5 patients (3.42%) required cross-matching. Notably, no patients necessitated blood transfusions during the intraoperative or immediate postoperative periods (Figure 1).

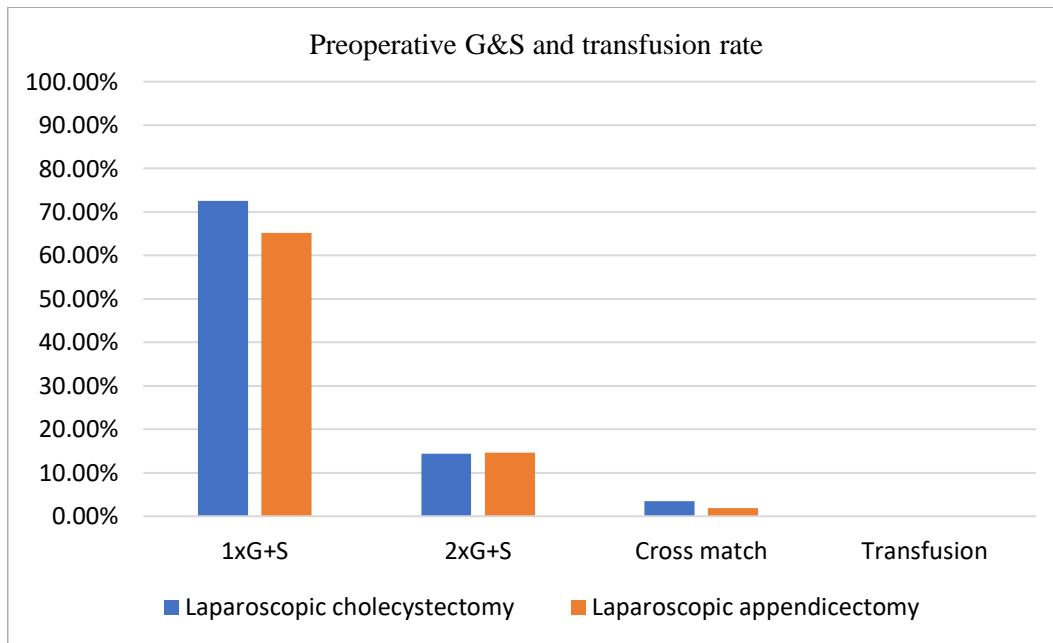


Figure1: Number of G&S and cross-match and transfusion rate

### Blood transfusion rate and Cost analysis

Over the 18-month study duration, the incidence of intraoperative or immediate postoperative blood transfusion was nil (0%) across the entire patient cohort undergoing both laparoscopic appendicectomy and cholecystectomy. The expense per Group and Screen (G&S) sample at our institution, inclusive of value-added tax, was £31 (equivalent to \$40 USD), with a processing time of up to 40 minutes. The aggregate expenditure for G&S samples during the study period amounted to £18,910 (equivalent to \$24,831 USD), excluding the costs associated with blood sampling consumables.

### Discussion

Our investigation corroborates existing literature<sup>[5]</sup> by highlighting the minimal requirement for perioperative blood transfusion in laparoscopic appendicectomy and cholecystectomy. Despite this established low transfusion probability, the routine practice of obtaining a Group and Save (G&S) sample before these procedures persists across hospitals in the United Kingdom. Individual hospitals operate under their own Maximum Surgical Blood Ordering Schedule (MSBOS), which dictates the necessity of G&S based on patient characteristics and procedural complexity. At Milton Keynes University Hospital, the local MSBOS recommends a single G&S for laparoscopic cholecystectomy but advises against G&S sampling prior to laparoscopic appendicectomy.

In this study, anemia was defined according to hemoglobin concentrations, specifically below 130 g/L for male patients and below 120 g/L for female patients. Among the 146 patients who underwent appendicectomy, 6 (4.10%) were diagnosed with anemia. Within the cohort of 164 patients undergoing cholecystectomy, 12 (7.31%) exhibited preoperative anemia, with a notable observation that only two of these anemic cases were within the subgroup undergoing elective cholecystectomy.

A substantial body of contemporary literature supports the safety of selectively omitting routine Group and Screen (G&S) blood sampling in uncomplicated laparoscopic surgeries<sup>[5,11-13]</sup>. Specifically, Quinn et al. propose a targeted strategy, advocating for G&S only in patients presenting with significant comorbidities or those receiving anticoagulant therapy<sup>[11]</sup>.

During the nascent phase of laparoscopic surgery adoption in the 1980s and 1990s, the nascent technical expertise led to elevated complication rates, including hemorrhagic events requiring blood transfusion. Consequently, routine preoperative blood grouping and screening (G&S) was implemented as standard

protocol. However, in the subsequent four decades, laparoscopic procedures have matured into a routine surgical modality. Contemporary surgical trainees now attain advanced laparoscopic proficiencies earlier in their training, contributing to a decline in bleeding complications and the associated need for transfusions. Furthermore, advancements in techniques, such as open port placement, have mitigated the risks of major vascular injury during the establishment of pneumoperitoneum<sup>[14-15]</sup>.

In the infrequent occurrence of a significant vascular injury requiring immediate blood transfusion, this institution, consistent with standard National Health Service (NHS) practice, implements the Major Haemorrhage Protocol. This protocol facilitates the rapid availability of uncrossmatched type O rhesus-negative blood, which is pre-positioned in operating theaters, thereby circumventing the time required for cross-matching in critical, life-threatening scenarios.

Cost analysis at Milton Keynes University Hospital indicated a potential saving of £18,910 (\$24,838) over the 18-month study period by avoiding routine Group and Screen (G&S) sampling for patients undergoing laparoscopic appendicectomy and cholecystectomy, as no transfusions were required within this cohort, including individuals with multiple comorbidities, those on anticoagulation, and those admitted due to intraoperative issues. In patients presenting with preoperative anemia, alternative strategies to minimize transfusion needs may include preoperative hemoglobin optimization, meticulous intraoperative hemostasis, and vigilant postoperative monitoring to ensure patient safety and enhance surgical outcomes.

Acknowledging the inherent constraints of our retrospective, single-center design, the observed outcomes are consistent with prior investigations, suggesting a need to re-evaluate the routine practice of obtaining Gram stain and culture (G&S) samples prior to laparoscopic appendicectomy and cholecystectomy. A prospective shift towards a selective strategy for G&S sampling could potentially optimize the utilization of healthcare resources without negatively impacting patient safety.

### Conclusions

Our investigation, corroborated by a thorough review of existing literature, indicates that blood transfusion during or immediately following laparoscopic cholecystectomy or appendicectomy is an infrequent occurrence. This finding suggests that routine preoperative blood group and screen (G&S) sampling for these

specific procedures is not warranted. Implementing this procedural modification has the potential to decrease healthcare expenditures without negatively impacting patient care or safety. A selective strategy for G&S sampling, guided by individual patient risk factors such as pre-existing medical conditions and anticoagulant medication use, may optimize resource allocation while upholding established clinical standards. This targeted approach promotes efficient healthcare delivery in the context of laparoscopic surgery and could result in substantial cost reductions and enhanced patient outcomes.

## Declarations

## Ethical Approval and Consent to participate

Not applicable as retrospective nature of study. Consent for publication: Not applicable as retrospective nature of study.

## Availability of supporting data

Upon request to the corresponding author.

## Competing Interests

Nil

## Funding Statement

Nil

## Author's Contributions

All authors made substantial contributions to the reported work, including in the areas of conception, study design, execution, data collection, analysis, and interpretation. They participated in drafting, revising, and critically reviewing the article, gave final approval for the version to be published, agreed on the journal for submission, and accepted responsibility for all aspects of the work.

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