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The Changing Landscape of Splenectomy in Women at a UK University Teaching Hospital: The Role of Gynaecological Oncology

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Abstract

Objective

To characterise the volume, indications and surgical context of splenectomy in adult women at a UK tertiary centre, comparing gynaecological oncology (GO) with general surgery and surgical subspecialities (GS), and to examine the distribution of procedural exposure between specialities.

Methods

Retrospective study of all female patients who underwent splenectomy at the University Hospitals of Derby and Burton (UHDB) NHS Foundation Trust, Derby, UK, from January 2014 to June 2025. Exclusion criteria were male sex, splenic biopsy only, splenunculus removal only and age <18 years. Data were extracted from electronic patient records and collated in Microsoft Excel. Categorical and continuous variables were summarised descriptively, with Fisher's exact test, the Mann-Whitney U test and negative binomial regression analyses used as appropriate; statistical significance was set at $p < 0.05$.

Results

Ninety-four women underwent splenectomy; 69 (73.4%) underwent elective procedures, and 25 (26.6%) underwent emergency procedures. GO performed 46/94 (49.0%) procedures and 46/69 (66.7%) elective procedures; all GO procedures were elective. GS performed 23/69 (33.3%) elective procedures, 48/94 (51.0%) of all splenectomies and all emergency splenectomies. GO splenectomies were undertaken for advanced Müllerian malignancy and formed part of cytoreduction, with concomitant omentectomy (97.8%), uterine/adnexal resection (84.8%) and colorectal resection (60.9%). In contrast, 79.2% of GS splenectomies were isolated procedures, and indications were heterogeneous. Malignant involvement was confirmed histologically in 89.1% of GO splenectomies. Among GS procedures for known or suspected malignancy, 7/15 (46.7%) had malignant involvement; among five procedures for suspected solid-organ malignancy, two (40%) were confirmed. The mean number of splenectomies per surgeon per year was 1.00 for GO compared with 0.23 for GS. Temporal trends were non-significant.

Conclusion

GO has become a major contributor to elective splenectomy in women. Its concentrated multivisceral practice contrasts with dispersed GS exposure. These findings highlight potential opportunities for cross-speciality discussion of operative experience and training.

Categories: Trauma, General Surgery, Oncology
Keywords: advanced ovarian cancer, general surgery, gyna oncology, #splenectomy, splenic neoplasms

Introduction

Splenectomy is an established surgical procedure traditionally performed by general surgeons and, increasingly, by other surgical subspecialities for a broad range of indications. These include elective procedures for haematological disorders and malignancy, as well as emergency procedures for trauma, splenic rupture and iatrogenic injury [1,2]. Consequently, exposure to splenectomy within general surgical practice encompasses both elective and emergency surgery and a range of operative approaches and clinical contexts.

The role of splenectomy has expanded with the development of cytoreductive surgery for advanced Müllerian malignancies [3-5]. In patients with advanced tubo-ovarian and primary peritoneal malignancy, achieving complete macroscopic cytoreduction may require resection of disease beyond the traditional boundaries of gynaecological surgery, including the upper abdomen and spleen. Where tumour involves the

splenic parenchyma or is densely adherent to the splenic capsule, splenectomy may be required to achieve complete macroscopic clearance. Splenectomy has therefore become an important component of the surgical repertoire of gynaecological oncologists undertaking advanced cytoreductive surgery and is incorporated within gynaecological oncology (GO) subspeciality training [6,7].

The expansion of GO into upper abdominal surgery raises questions regarding the distribution and nature of splenectomy experience between specialities. While clinical contexts and patient demographics inherently differ between specialities, the fundamental surgical anatomy and intraoperative principles of splenectomy remain shared [8,9]; thus, this study evaluates institutional procedural exposure rather than disease-specific outcomes. GO surgeons generally undertake splenectomy as part of planned open multivisceral cytoreduction, whereas general surgeons and their subspecialities (GS) perform splenectomy across a broader spectrum of elective and emergency indications, including procedures undertaken for acute haemorrhage or traumatic injury. Repeated exposure to a procedure is an important component of maintaining operative proficiency [10]; therefore, characterising splenectomy volume distribution across disciplines may identify opportunities for shared surgical training and experience.

The indication for splenectomy and its relationship with final histopathology are also clinically relevant, particularly where splenic involvement by malignancy is suspected [11]. In GO, splenectomy may be undertaken because of suspected splenic involvement by malignancy, encompassing both capsular/surface disease and parenchymal invasion. Conversely, splenectomy performed by GS may be undertaken for suspected malignant disease, including lymphoma or metastatic solid-organ malignancy, but the frequency with which suspected malignant involvement is confirmed histologically is less well defined. Characterising this relationship across different surgical pathways may provide insight into the clinical and oncological context in which splenectomy is performed.

In this study, we therefore examined splenectomy in an adult female cohort at a tertiary centre where GO and GS services perform splenectomy. We compared splenectomies performed by GO and GS in terms of procedural volume, temporal trends, surgical indications, concomitant organ resections and final histopathological findings. To account for the differing clinical contexts within GS, procedures were further categorised as elective (GSEl) or emergency (GSEm), allowing comparison across three clinically distinct groups.

Materials And Methods

Study aims and objectives

Primary Objective

To characterise the volume and distribution of splenectomy among adult women at a tertiary centre and compare practice between GO and GS pathways.

Secondary Objectives

To compare operative urgency (elective vs. emergency) and concomitant organ resections between GO and GS.

To compare indications and final splenic histopathology and to assess operator volume concentration across GO, GSEl and GSEm cohorts to identify potential scope for multidisciplinary surgical collaboration.

To evaluate the temporal trends of splenectomies in adult females at a tertiary centre, comparing GO with GS pathways.

Ethics and governance

This retrospective study was conducted at University Hospitals of Derby and Burton (UHDB) NHS Foundation Trust, Derby, UK, under the trust's ongoing quality standards registration framework, in accordance with local institutional governance procedures. In accordance with NHS Health Research Authority guidelines, formal ethical review by an NHS Research Ethics Committee was not required, as the project involved the retrospective evaluation of anonymised clinical records with no direct patient contact or alteration to clinical care. Individual informed consent was waived in accordance with trust governance guidelines for retrospective audit and service evaluation.

Patient population

All patients who had their spleen or any splenic tissue removed at UHDB NHS Foundation Trust between January 2014 and June 2025 (138 months) were identified using a prospective institutional histology database via the Business Intelligence team, which supports the extraction of routinely collected patient and procedural data for clinical audit and research. The inclusion criteria were female sex, age of 18 years or more and spleen removal. Patients were excluded if they were male, were aged under 18 years, underwent

splenic biopsy only or underwent removal of a splenunculus (accessory spleen) only. As this was a retrospective study, all eligible cases identified during the predefined study period were included; therefore, no a priori sample size calculation was performed.

Methods

Splenectomy was incorporated into cytoreductive surgery at the Derby Gynaecological Cancer Centre (DGCC), UHDB, in 2015. Four GO subspeciality consultants performed cytoreductive surgery for advanced Müllerian malignancy after each case was discussed at the GO multidisciplinary team (MDT) meeting and radiologically staged with the help of a computerised tomography (CT) scan of the chest, abdomen and pelvis as per British Gynaecological Cancer Society (BGCS) guidelines [12]. Two GO consultants perform an initial disease assessment on any patient simultaneously, and a decision to perform splenectomy is made if the spleen is found to be clinically involved by the cancer.

The UHDB surgical unit performs both emergency and elective splenectomies. Surgical emergency cover is available 24/7, and patients are referred from the emergency department to the surgical assessment unit where appropriate. The study was conducted within UHDB NHS Foundation Trust, a single NHS Trust comprising two hospital sites: Royal Derby Hospital and Queen's Hospital Burton.

Relevant study data were captured by accessing a combination of patient electronic care records, operation notes and histology, populating a study proforma with the following clinical variables: patient age, surgical subspeciality, date of surgery, indication for surgery, urgency, concomitant organs removed and final histology. Splenectomies were categorised as GO and GS, where GS was further subdivided into GSEl and GSEm.

Statistical analysis

Categorical variables were summarised as frequencies and percentages, while continuous variables were presented as means, medians or ranges, as appropriate. Continuous variables were compared using the Mann-Whitney U test due to their non-normal distribution, and categorical variables were compared using Fisher's exact test. Temporal trends in annual splenectomy counts were assessed using negative binomial regression to account for overdispersion. The model included surgical speciality (GS as the reference group), calendar year as a continuous variable (centred at 2016) and a speciality-by-year interaction. Regression analysis was restricted to complete calendar years from 2016 to 2024, following the introduction of GO splenectomy in October 2015. Statistical analyses were performed using R software (version 4.5.3; R Foundation for Statistical Computing, Vienna, Austria), including the MASS package (version 7.3-65) for negative binomial regression. Statistical significance was set at $p < 0.05$.

Results

Patient and disease characteristics

Patient identification and cohort selection are summarised in Figure *1*.

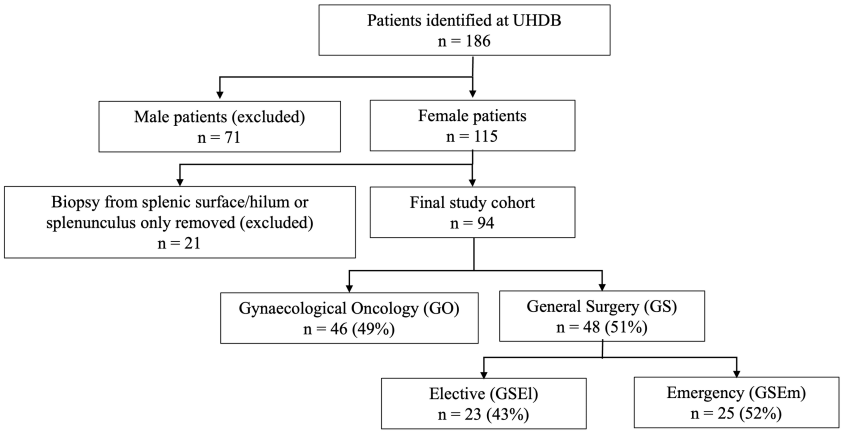


FIGURE 1: Study cohort selection and stratification flow diagram.

Flowchart showing patient identification, exclusion steps and subgroup division by surgical speciality and admission type at University Hospitals of Derby and Burton (UHDB) NHS Foundation Trust, Derby, UK, over 138 months.

Of the 94 female patients who underwent splenectomy, 69 (73.4%) underwent elective and 25 (26.6%) underwent emergency procedures. GO performed 46/69 (66.7%) of elective splenectomies and 46/94 (49.0%) of all female splenectomies. GS performed the remaining 23/69 (33.3%) elective procedures and 48/94 (51.0%) of all splenectomies. All splenectomies performed by GO were elective, whereas GS performed all emergency splenectomies.

A detailed comparison of the GO and GS cohorts is presented in Table *1*.

Characteristics	GO (46)	GS (48)	p-value
Age (years)			
Median	69	58	0.014
Range	51-81	19-88	
Indications			
Benign	0	33 (68.8%)	<0.001
Malignancy (known/suspected)	46 (100%)	15 (31.2%)	
Surgical details			
Urgency of the surgery			
Elective	46 (100%)	23 (47.9%)	<0.001
Emergency	0	25 (52.1%)	
Organs removed with spleen			
Spleen only	0	38 (79.2%)	<0.001
Omentum	45 (97.8%)	1 (2.08%)	<0.001
Small intestine	10 (21.7%)	3 (6.3%)	0.038
Large intestine	28 (60.9%)	6 (12.5%)	<0.001
Pancreas	1 (2.2%)	1 (2.1%)	1
Kidney	0	2 (4.2%)	0.495
Uterus/fallopian tubes/ovaries	39 (84.8%)	0	<0.001
Histology			
No malignant involvement	5 (10.9%)	38 (79.2%)	<0.001
Malignant involvement: parenchymal	11 (23.9%)	9 (18.7%)	
Malignant involvement: surface only	30 (65.2%)	1 (2.1%)	

TABLE 1: Comparison of splenectomy between GO and GS.

Data are presented as n (%). Age was compared using the Mann-Whitney U test, and categorical variables were compared using Fisher's exact test. Statistical significance was defined as $p < 0.05$.

GO = gynaecological oncology; GS = general surgery and surgical subspecialities

The most common indication for splenectomy in the GO group was advanced-stage high-grade serous carcinoma. In contrast, the GS group had a more heterogeneous range of indications, with iatrogenic injury being the most common, followed by malignancy (Table *2*).

GS indication	Elective (GSEl; n = 23)	Emergency (GSEm; n = 25)	Total (n = 48)	p-value	Malignancy on final histology (n = 10)
Benign					
Iatrogenic (injury to spleen)	4 (8.3%)	8 (16.7%)	12 (25%)	1.000	0
Spontaneous rupture/hematoma	0	6 (12.5%)	6 (12.5%)	0.023	2/6 (33.3%)
Trauma	0	6 (12.5%)	6 (12.5%)	0.023	0
Haematological	5 (10.4%)	0	5 (10.4%)	0.019	0
Abscess	2 (4.2%)	2 (4.2%)	4 (8.3%)	1.000	1/4 (25%)
Malignant					
Known lymphoma	2 (4.2%)	3 (6.2%)	5 (10.4%)	1.000	3/5 (60%)
Suspected lymphoma	5 (10.4%)	0	5 (10.4%)	0.020	2/5 (40%)
Solid-organ malignancy	5 (10.4%)	0	5 (10.4%)	0.020	2/5 (40%)

TABLE 2: Splenectomy indications in GS and their histology correlation.

Data are presented as n (%). The distribution of elective and emergency procedures across indications was compared using Fisher's exact test. Statistical significance was defined as $p < 0.05$.

GS = general surgery and surgical subspecialities

Temporal trends of splenectomy

Following the incorporation of splenectomy into cytoreductive surgery in 2015, GO performed its first splenectomy in October 2015. Figure *2* illustrates the annual distribution of splenectomies performed by GO and GS.

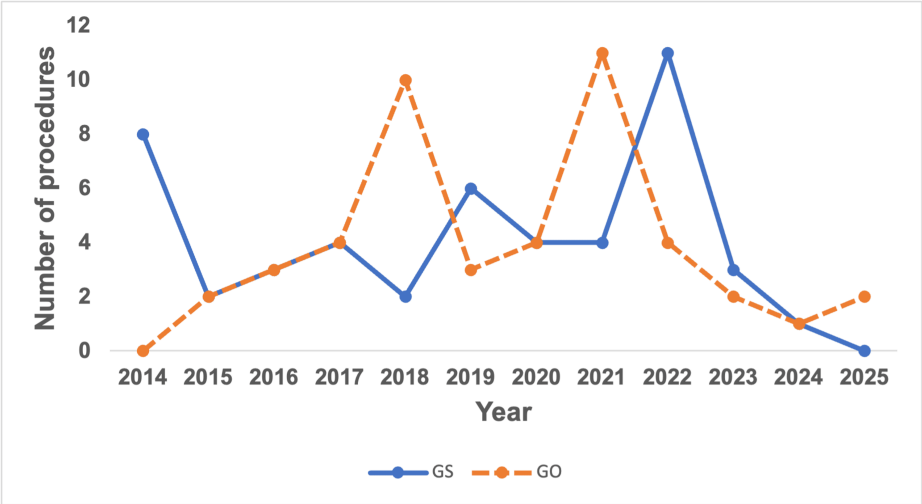


FIGURE 2: Annual trends in splenectomy volume between GO and GS from 2014 to 2025.

Line graph displaying the annual number of splenectomies performed in adult females by GO (orange) and GS (blue).

GO = gynaecological oncology; GS = general surgery and surgical subspecialities

Negative binomial regression, accounting for overdispersion ($\theta = 5.63$), was restricted to complete calendar

years (2016-2024) following the introduction of GO splenectomy in October 2015. There was no statistically significant difference in baseline splenectomy rates between GO and GS at the reference year of 2016 (rate ratio, 1.62; 95% CI, 0.53-5.05; p = 0.379). No significant linear temporal trend was observed in GS (rate ratio, 1.02; 95% CI, 0.86-1.22; p = 0.790), and the speciality-by-year interaction was not significant (rate ratio, 0.91; 95% CI, 0.71-1.16; p = 0.397), indicating no evidence of differing linear temporal trends between the two specialities.

Comparison of concomitant organs removed between GO and GS

Splenectomies performed by GO were generally associated with more extensive multivisceral surgery. The most frequently resected organs or structures alongside the spleen were the omentum (97.8%, n = 45), uterus and adnexa (84.8%, n = 39) and colorectum (60.9%, n = 28) (Table *1*). In contrast, splenectomy was performed as an isolated procedure in 79.2% (n = 38) of GS cases. Where additional organs were removed, the colorectum was the most common concomitant resection (12.5%, n = 6).

Analysis of splenectomy due to malignancy

All GO splenectomies were performed for known or suspected malignancy, compared with a minority of GS procedures. Within the GS cohort, five cases involved suspected splenic involvement by solid-organ malignancy, while the remaining malignant indications were related to known or suspected lymphoma (Table *1*).

In the GO cohort, final histology confirmed malignant involvement in 89.1% of spleens, with involvement confined to the capsule or hilum in the majority of cases (65.2%, n = 30) and parenchymal involvement in 23.9% (n = 11). Five spleens (10.9%) showed no malignancy, giving a positive predictive value of 89.1% for suspected splenic involvement.

In the GS cohort, malignant involvement of the spleen was confirmed on final histology in 7/15 (46.7%) splenectomies performed for known or suspected malignancy. The histological correlation with the recorded indications is detailed in Table *2*. Lymphoma constituted a substantial component of malignant GS indications. Among the five cases in which splenic involvement by solid-organ malignancy was suspected, only two (40%) were confirmed on final histology.

Splenectomy volume distribution

All GO splenectomies were performed by four consultants. In contrast, GS splenectomies were distributed across several surgical subspecialities, with colorectal surgeons performing the largest number (n = 18, 37.5%), followed by upper gastrointestinal surgeons (n = 17, 35.4%) (Table *3*).

Speciality	Total number of splenectomies (n = 94)	Elective (n = 69)	Emergency (n = 25)	Splenectomy per year	Number of individual operating surgeons	Splenectomies per surgeon per year
GO	46 (49.0%)	46 (66.7%)	0	4.00	4	1.00
GS	48 (51.0%)	GSEl = 23 (33.3%)	GSEm = 25 (100.0%)	4.17	18	0.23
Colorectal	18 (19.1%)	13 (18.8%)	5 (20.0%)	1.57	7	0.22
Upper GI	17 (18.1%)	4 (5.8%)	13 (52.0%)	1.48	7	0.21
Urology	3 (3.2%)	3 (4.3%)	0	0.26	2	0.13
Vascular	1 (1.1%)	0	1 (4.0%)	0.09	1	0.09
Maxillofacial	1 (1.1%)	0	1 (4.0%)	0.09	1	0.09
Unknown	8 (8.5%)	3 (4.3%)	5 (20.0%)	0.70	-	-

TABLE 3: Distribution of splenectomy among surgical specialities.

Data are presented as n (%) for total, elective and emergency splenectomies, and as rates or counts where indicated. Annualised splenectomies = total number of splenectomies divided by the 11.5-year study period. Splenectomies per surgeon per year = total number of splenectomies divided by 11.5 years and by the number of individual surgeons who performed at least one splenectomy during the study period. Percentages in the total, elective and emergency columns are calculated using denominators of 94, 69 and 25, respectively.

GO = gynaecological oncology; GS = general surgery and surgical subspecialities

GO consultants performed an average of 1.00 splenectomies per surgeon per year, compared to 0.23 for GS. Overall elective procedural volume per surgeon during the study period was 11.5 procedures among GO consultants (46/4), compared with 1.44 among GSEl consultants (23/16). The latter calculation included only 16 of the 18 surgeons in the GS cohort, as two surgeons (one maxillofacial and one vascular) performed emergency splenectomies exclusively, with no contribution to elective procedures.

Discussion

This 11-year retrospective study demonstrates a paradigm shift in the delivery of upper abdominal surgery within a tertiary centre, with GO performing half of all splenectomies in adult females. While GS indications were highly heterogeneous, spanning trauma, iatrogenic injury and benign haematological conditions, GO splenectomies were uniformly performed as planned open multivisceral cytoreduction for advanced Müllerian malignancy, contrasting with predominantly solitary resections in GS. Notably, 90% of GO splenectomies for suspected malignant involvement yielded positive histopathology, compared with only 40% of GS splenectomies performed for suspected solid-organ malignancy. Furthermore, individual procedure exposure was more than four times higher per GO surgeon than per GS consultant.

The temporal trends observed highlight the evolving nature of surgical practice. The decline in surgical volume during 2019-2020 followed by a surge in 2021-2022 reflects the systemic disruption caused by the COVID-19 pandemic on elective surgical pathways, aligning with national data reported across England and Wales [13]. Crucially, the peaks in GO splenectomy volume in 2018 and 2021 did not coincide with an increase in histologically normal spleens removed. This validates that expanding upper abdominal cytoreduction in GO does not lead to unnecessary organ resection, reinforcing previous evidence that aggressive surgical intent can be balanced with diagnostic accuracy [14].

The marked difference in malignant histopathology yield, 90% in GO compared with 40% in GS solid-organ resections, must be interpreted within the context of distinct clinical pathways, disease biology and surgical objectives. In advanced Müllerian malignancies, systematic upper-abdominal cytoreduction routinely exposes the splenic hilum, capsule and parenchyma, providing GO surgeons with frequent opportunities to identify subtle metastatic disease and refine pattern recognition within the characteristic peritoneal dissemination model of epithelial ovarian cancer [10,15]. Because solitary or oligometastatic splenic involvement from non-gynaecological solid tumours is exceptionally rare [11], the pre-test probability of splenic malignancy is inherently higher during cytoreductive procedures, which naturally elevates the positive predictive value of surgical inspection and the resulting histological yield. However, any direct comparison between these specialities is significantly limited by the small sample size of general surgical splenectomies performed for suspected solid-organ malignancy (n = 5), restricting the statistical power and generalisability of these findings.

On the other hand, approximately one-quarter of splenectomies in the GS group resulted from iatrogenic splenic injuries, a figure consistent with the 15-40% incidence reported in the literature [16,17]. The finding that iatrogenic splenectomy was twice as frequent during emergency procedures underscores the technical challenges posed by intraoperative acute haemorrhage and altered tissue planes during emergency laparotomy. Given the lifelong immunological and thromboembolic risks associated with asplenia, these data emphasise the need for meticulous surgical dissection during left upper quadrant mobilisations.

Our findings carry significant implications for surgical subspeciality training and proficiency maintenance. As general surgical training increasingly subspecialises (e.g., colorectal, upper GI) and minimal access approaches replace open procedures [18,19], individual GS consultant exposure to open splenectomy is diminishing. Dixon and Horgan (2019) [17] highlighted this issue, noting that reduced exposure can limit operative competence and contribute to higher morbidity, particularly in the emergency setting. They also reported that elective splenectomy is largely concentrated within a few subspecialities, further narrowing training opportunities. In contrast, subspeciality training in GO formalises exposure to upper abdominal cytoreduction. With GO surgeons maintaining higher individual elective open splenectomy volumes, these results support the development of joint operative models and cross-speciality mentorship to preserve complex open surgical skills across trust networks. Moreover, greater GO involvement in elective cases could expand service capacity, directly addressing current gaps in both training and patient care.

Although postoperative complications were beyond the primary scope of this study, asplenic patients face lifelong risks of overwhelming post-splenectomy infection (OPSI) and venous thromboembolism [20-22]. These shared clinical risks highlight a clear need for joint institutional protocols between GO and GS to standardise perioperative care. Comprehensive management pathways must incorporate timely vaccination against encapsulated organisms, extended thromboprophylaxis, patient education and prompt primary care notification. Harmonising these measures across surgical pathways, alongside strengthened interdisciplinary trainee education aligned with national curriculum standards, will reinforce surgical safety and optimise long-term outcomes in this complex cohort.

Strengths and limitations

The principal strength of this study lies in its focus on a well-defined adult female cohort across 138 months.

By evaluating the precise demographic population where GO and GS clinical pathways directly overlap, this design restricts the analysis to women, thereby improving comparability with the exclusively female GO cohort. Furthermore, while technical indications differ, the shared fundamental surgical anatomy, intraoperative principles and postoperative risks (such as haemorrhage, sepsis and venous thromboembolism) provide a robust, clinically meaningful basis for direct cross-speciality comparison.

Limitations include the retrospective design, the relatively small absolute annual case volumes and the single NHS Trust setting, which may limit generalisability to other healthcare settings. Although male general surgery patients (n = 71, including isolated splenic biopsies and accessory splenectomies) were excluded to maintain demographic uniformity across cohorts, incorporating them would not alter our primary finding: procedure exposure per individual general surgeon remains substantially lower than that among gynaecological oncologists. Moreover, the study did not evaluate perioperative morbidity, mortality or long-term outcomes and therefore cannot determine whether differences in procedural exposure translated into differences in surgical outcomes.

Conclusions

GO has become a substantial contributor to elective splenectomy in women at this centre, with procedures concentrated among a small number of consultants and occurring predominantly as part of multivisceral cytoreduction. As individual procedure exposure is distributed across a larger number of general surgical consultants, opportunities for cross-speciality collaboration and shared learning may warrant further exploration. Interdisciplinary discussion of operative experience and perioperative safety protocols may help identify opportunities to support the maintenance of complex upper abdominal surgical skills across trust networks.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Mahwish Nayab, Andrew Phillips

Acquisition, analysis, or interpretation of data: Mahwish Nayab, Safa Asghar, Viren Asher, Susan Addley, Summi Abdul, Anish Bali

Drafting of the manuscript: Mahwish Nayab

Critical review of the manuscript for important intellectual content: Mahwish Nayab, Safa Asghar, Viren Asher, Susan Addley, Summi Abdul, Anish Bali, Andrew Phillips

Supervision: Andrew Phillips

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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