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The case for a new post-graduate hernia designation: a review of fellowship council case logs from the past twelve-years

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Abstract

Background The Fellowship Council (FC) is a robust accreditation body with numerous fellowships; however, no specific criteria exist for hernia fellowships. This study analyzed the case log database to evaluate trends in fellowship exposure to hernia repairs.

Methods FC hernia case log records (2007–2019) were coded as inguinal or ventral hernias and with or without mesh repair. Retrospective analysis examined total hernia repairs logged, type of repair, program designation, and robotic adoption. Robotic adoption was categorized by quartiles of program performance according to the final year of analysis (2018–2019); yearly performance was then graphed by quartiles.

Results Over this twelve-year period, 93,334 hernia repairs, 5 program designations, 152 unique programs and 1,558 unique fellows were analyzed. The number of fellows grew from 106 (2007–2008) to > 130 (2018–2019). Total hernias repairs per fellow increased from an average of 41.2 in 2007–2008 to 75.7 in 2018–2019 (183.7%). Open and robotic hernia repairs increased by 241.9% and 266.3%, respectively; laparoscopic hernia repairs decreased by 14.8%. Inguinal and ventral hernia repairs comprised 48.1% and 51.9% of total cases, respectively.

Advanced GI/MIS and Advanced GI/MIS/Bariatrics programs logged the majority of hernia repairs (86.0–90.2%). 2014 began an exponential rise in robotic adoption, with fellows averaging < 1 robotic repairs before and > 25 repairs in 2019. A significant difference was found between all groups when comparing quartiles of robotic adopters (median robotic repairs per fellow; IQR): first quartile (72.0; 47.9–108.8), second quartile (25.5; 21.0–30.6), third quartile (13.0; 12.0–14.3) and fourth quartile (3.5; 0.5–5.0) (p-value < 0.05).

Conclusions This twelve-year analysis shows a near doubling in the growth of total hernia repairs, with a decrease in laparoscopic repairs as robotic repairs increased. These data show the importance of hernia repairs in FC fellows' training and warrant further granular analysis to determine specific accreditation criteria for hernia fellowship designations.

Keywords Inguinal Hernia · Ventral Hernia · Robotic Surgery · Fellowship Council · Fellowship Case Log · Hernia Fellowships

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Abdominal wall hernias (including groin hernias) are a common surgical condition. Their repairs have been traditionally taught in residency and graduating trainees have been considered competent to offer hernia repairs in practice [1–4]. However, given our aging population within the United States as well modifiable factors that may not always be optimized (i.e., smoking, obesity), there are an increased number of recurrences that may make repairs more complex [5]. Additionally, there is considerable variability in repair technique, especially with the recent growth in popularity of abdominal wall reconstruction and robotic techniques [6–8]. Accordingly, there has been an evolution both in the United States and elsewhere for abdominal wall hernia repair to be considered its own specialty area [9].

The recognition of hernia repair as its own specialty area also points to the need to develop robust training opportunities in abdominal wall management. Given the limited amount of time and breadth of content that must be mastered during general surgery residency, fellowships have become quite popular, with over 80% of graduates seeking such focused training options [10–12]. Existing literature has found that residents seek fellowship training due in part to a lack of comfort with certain procedures, including abdominal wall hernia repairs [13, 14]. Increasing complexity, market demands, and the lack of general surgery graduate confidence demonstrate the need for this type of fellowship designation [5, 13].

In addition to the traditional surgical fellowships accredited by the Accreditation Council for Graduate Medical Education (ACGME), the Fellowship Council (FC) offers numerous fellowships, such as Bariatric, Foregut, Hepatopancreaticobiliary, and Advanced Gastrointestinal/Minimally Invasive Surgery [15]. In keeping with national trends, FC fellowships are very competitive, with a match rate of 68% for 274 applicants in the 2020–2021 match cycle [16]. While some abdominal wall hernia fellowships are offered at an institutional level, such fellowships have not been organized under any national accrediting body and therefore consistent standards for this training do not exist.

Recently, the FC initiated discussions with the Americas Hernia Society (AHS) and the Society for Gastrointestinal and Endoscopic Surgery (SAGES) to explore this area in the hopes of establishing an FC Abdominal Core Health Fellowship. The purpose of this study was to examine the volume of hernia repairs performed in existing FC fellowships and trends over time as baseline information for this initiative.

Materials and methods

Case log data

This study was reviewed by the University of Texas Southwestern (UTSW) IRB and was deemed exempt. This manuscript has been reviewed and approved by the FC Research Committee and Board of Directors as well as the SAGES Resident and Fellow Training Committee, Executive Committee, and Community Practice Committee, and the AHS executive committee. The FC provided de-identified case log information for all fellows between 2007 (earliest year of data available) and 2019 (year when case log system changed), which included the fellow's program designation, the surgical approach, the category of hernia repair, subcategories, and count of procedures. Data were organized by academic year, designated as the end date of that year (e.g., 2007–2008 is written as 2008). We did not include data after AY 2019, as the FC implemented a new case log system for hernias at that time. This change increased the granularity in which hernia cases were logged, allowing for more detailed information regarding the type and complexity of repair.

Inclusion criteria

To ensure we were including fellows and program designations with significant hernia contributions, we performed two screenings of the data. We first calculated the average hernia repairs per fellow by program designation to identify the designations with minimal contributions and exclude them (< 10 hernia repairs). The remaining program designations included were Advanced GI, Advanced GI/MIS, Advanced GI/MIS/Bariatric, Advanced GI/MIS/Bariatric/Flexible Endoscopy, and Advanced GI/MIS/Flexible Endoscopy. The second screening was to remove any fellows who appeared to not complete training or did not consistently log hernia cases (< 50 total cases (including non-hernia repairs) or no hernia repairs).

Coding

Hernia repairs were categorized by category of hernia and subcategories. The category of hernias was coded as inguinal (inguinal, femoral, or obturator) and ventral (incision, ventral, or parastomal). Subcategories included required information such as the use of mesh, as well as optional information such as enterocutaneous fistula presence, recurrent hernia, and occasionally the type of operation (e.g., components separation). Subcategories were thereby defined as "with mesh repair" or "without mesh repair"; enterocutaneous fistulas with hernia repair not otherwise classified were included in the "without mesh repair" group for the purposes of our study.

Data analysis

Descriptive statistical analyses were performed on all data and are represented as the average number of repairs per fellow unless otherwise indicated. This was determined by the

total number of repairs divided by the number of fellows in that given academic year.

For robotic operations, we also analyzed the data as robotic repairs per program and repairs per fellow to examine trends regarding adoption. The number of repairs performed by each program in the academic year of 2019 was used to categorize programs into quartiles of robotic hernia repair volume.

Non-parametric statistical analysis using the Mann–Whitney-U test was performed using R-Studio® Version 1.3.959. A P-value of < 0.05 was considered significant.

Results

Baseline data and program characteristics

Case log data were analyzed from 2008 to 2019, according to the above inclusion criteria. In this time a total of 93,378 unique hernia repairs were logged. This corresponded to a total of 5 program designations, 123 unique programs and 1,519 unique fellows (Table 1) that were included in our analysis. From the five program designations included in our analysis, total of 198 trainees were excluded (50% Advance GI MIS, 34% Advanced GI/MIS/Bariatrics, 13% Advanced GI, 2% Advanced GI/MIS/Flex Endo, and 1% Advanced GI/MIS/Bariatrics/Flex Endo). The number of existing programs in our analysis grew from 67 in 2008 to 107 by 2019. Somewhat similarly, there was an initial growth in the number of fellows from 106 in 2008 to > 130 in 2011, which then remained consistent through 2019. In any given academic year, Advanced GI had 6–13 programs per year, Advanced GI/MIS 35–53, Advanced GI/MIS/Bariatrics 24–41, Advanced GI/MIS/Bariatrics/Flexible Endoscopy 1–2, and Advanced GI/MIS/Flexible Endoscopy 1(Table 2). Similarly, Advanced GI had 10–15 fellows per year, Advanced GI/MIS 57–71, Advanced GI/MIS/Bariatrics 37–56, Advanced GI/MIS/Bariatrics/Flexible Endoscopy 1–2, and Advanced GI/MIS/Flexible Endoscopy 1(Table 2). This equates to an average of 1–2 fellows per program per year.

Table 1 Demographic information of programs and fellows included for analysis in each academic year

Academic year	Number of program types	Number of programs	Number of fellows
Total Unique	5	123	1519
2008	5	67	106
2009	5	77	124
2010	5	79	119
2011	5	89	134
2012	5	94	138
2013	5	97	137
2014	5	98	134
2015	5	100	135
2016	5	100	134
2017	5	100	136
2018	5	103	139
2019	5	107	135

Total hernia repairs

Total hernia repairs logged over the course of our study more than doubled from 4,369 in 2008 to 10,224 in 2019. When evaluating the average number of repairs performed by each fellow (total number of cases/total number of fellows), there was also a near doubling from 41.2 hernia repairs per fellow in 2008 to 75.7 in 2019. This represents a 183.7% increase in repairs logged per fellow over these twelve academic years (Fig. 1). This rise was reflected evenly between inguinal and ventral hernia repairs. Inguinal hernia repairs increased from 21.3 to 36.0 hernia repairs per fellow, respectively, and represented 48.1% of the total logged cases. Ventral hernia repairs increased from 19.9 to 39.7 hernia repairs per fellow, respectively, and represented 51.9% of the total logged cases. Total repairs with mesh vastly outnumbered repairs without mesh at 88.1% and 11.9%, respectively; a relatively even split was noted for mesh repairs between inguinal (53%) and ventral (47%) repairs (Fig. 2).

Open hernia repairs

Over the course of this twelve-year case log period, total open hernia repairs logged increased by 241.9% from 9.9 to 24.1 open hernia repairs per fellow (Fig. 1). Total open repairs logged were 1,054 in 2008 to 3,247 in 2019. Overall, open ventral hernia repairs with mesh accounted for 42.9% of cases, inguinal hernia repairs with mesh for 27.3%, ventral hernia repairs without mesh for 27.1%, and inguinal hernia repairs without mesh for 2.7% (Fig. 3). The growth in open repairs was reflected evenly across all operative repair types except again inguinal hernia repairs without mesh.

Laparoscopic hernia repairs

Laparoscopic hernia repairs were the predominant repair type in 2008, accounting for 75.6% of the total hernia repairs (Fig. 1). Open repairs represented 24.1% and robotic merely 0.2%. By 2019, the share of hernias repaired laparoscopically had fallen to only 35.1%, while open (31.7%) and robotic (33.2%) repairs had both increased to a similar proportion. Interestingly, the annual number of hernias repaired laparoscopically were 3,305 in 2008 and 3,586 in 2019. However, considering the increases in both total hernia repairs and the number of fellows, this resulted in a

Table 2 Demographics broken down by program designations and respective number of programs (fellows) per academic year

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Advanced	6 (10)	7 (12)	7 (12)	8 (13)	10 (14)	10 (15)	11 (14)	10 (13)	10 (13)	10 (12)	12 (150	13 (15)
Adv GI/MIS	35 (57)	41 (65)	40 (59)	46 (66)	49 (70)	51 (71)	50 (67)	52 (69)	53 (69)	53 (69)	53 (71)	50 (61)
Adv GI/MIS/Bariatric	24 (37)	27 (44)	30 (46)	33 (53)	33 (51)	34 (48)	35 (50)	36 (50)	35 (50)	35 (52)	36 (50)	41 (56)
Adv GI/MIS/Bariatrics/Flex Endo	1 (1)	1 (2)	1 (1)	1 (1)	1 (2)	1 (2)	1 (2)	1 (2)	1 (1)	1 (2)	1 (2)	1 (2)
Adv GI/MIS/Flex Endo	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)
Total	67 (106)	77 (124)	79 (119)	89 (134)	94 (138)	97 (137)	98 (134)	100 (135)	100 (134)	100 (136)	103 (139)	107 (135)

MIS minimally invasive surgery, *Flex Endo* flexible endoscopy

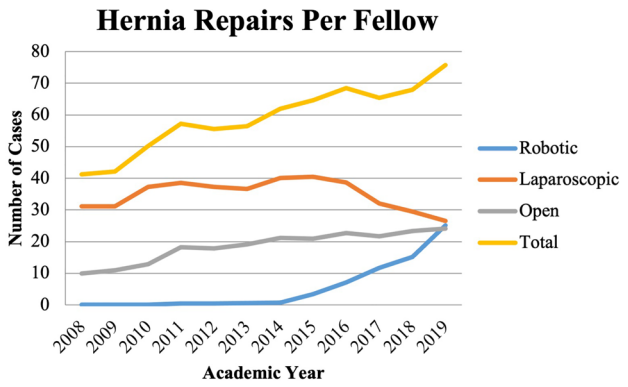

Fig. 1 The average number of hernia repairs logged per fellow from 2008 to 2019 further broken down by operative technique

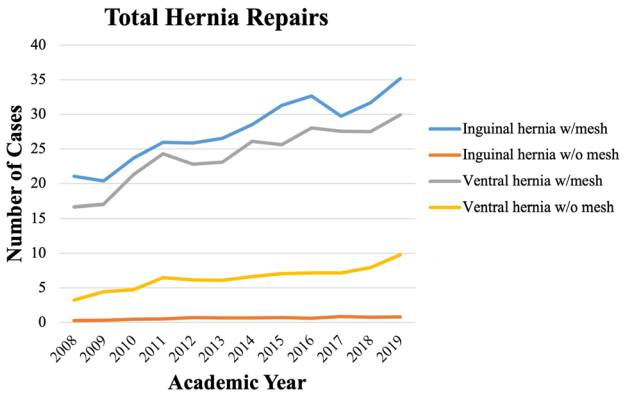

Fig. 2 The average number of hernia repairs logged per fellow from 2008 to 2019 further broken down by type of repair

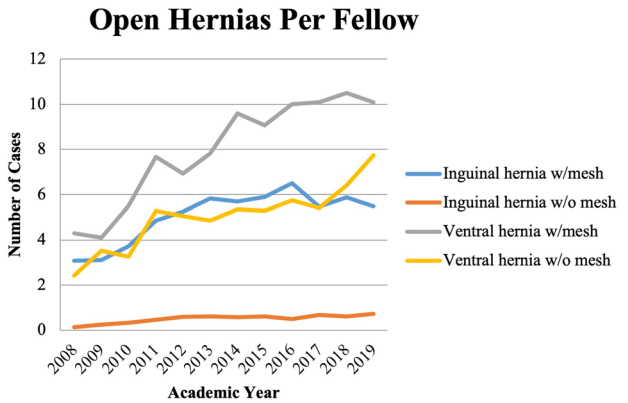

Fig. 3 The average number of open hernia repairs logged per fellow from 2008 to 2019 further broken down by type of repair

decreased proportion of laparoscopic repairs by 14.8% (31.2 to 26.6 laparoscopic repairs per fellow). Like open repairs, laparoscopic repairs with mesh vastly outnumbered repairs without mesh (96.0% and 4.0%, respectively, Fig. 4). Total

laparoscopic inguinal hernia repairs with mesh (59%) outnumbered ventral hernia repairs with mesh (41%) and the overall decrease in laparoscopic repairs per fellow was seen for both inguinal and ventral hernia repairs (Fig. 4).

Robotic hernia repairs

From 2014 to 2019, there was an exponential increase in robotic adoption with fellows averaging < 1 robotic repairs in prior years compared to > 25 repairs in 2019 (Fig. 1). Robotic hernia repairs per fellow rose by 266.3% during this same interval. From 2008 to 2014 a total of 328 robotic repairs were logged; in 2015 there were 457 robotic repairs, and in 2019 there were 3,391 robotic repairs logged. This represented an increase from 0.1 cases per fellow per year in 2008 to 25.1 in 2019. Mesh repairs vastly outnumbered repairs without mesh (97.9% and 2.1%, respectively) and inguinal and ventral hernia repairs with mesh were evenly represented at 51% and 49%, respectively (Fig. 5).

Hernia repairs by program designation

Data analysis was performed for the five program designations that met inclusion criteria: (1) Advanced GI, (2) Advanced GI/MIS, (3) Advanced GI/MIS/Bariatrics, (4) Advanced GI/MIS/Bariatrics/Flexible Endoscopy, and (5) Advanced GI/MIS/Flexible Endoscopy. When evaluating total hernia repairs performed by any given program designation, Advanced GI/MIS and Advanced GI/MIS/Bariatrics together logged a consistent majority ranging from 86.0 to 90.2% (Fig. 6). When examining these cases by operation type, the same two designations together, again account for the majority: 87.7% open hernia repairs, 92.1% laparoscopic hernia repairs and 90.6% robotic hernia repairs (Table 3). These two program designations also represent the majority of programs and fellows; however, the contribution of hernia repairs from these program designations was proportional to the total number of fellows per programs.

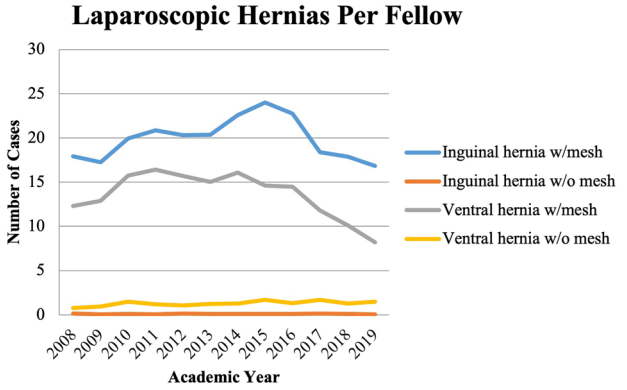

Fig. 4 The average number of laparoscopic hernia repairs logged per fellow from 2008 to 2019 further broken down by type of repair

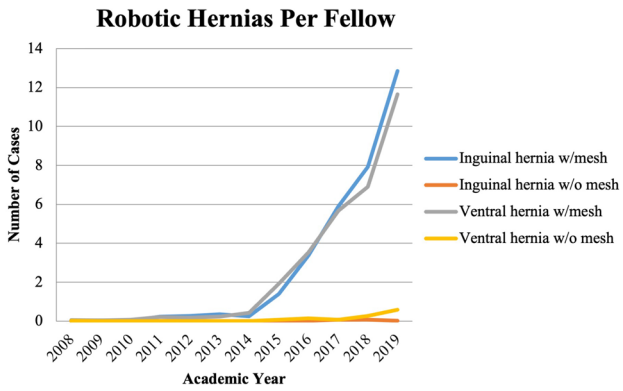

Fig. 5 The average number of robotic hernia repairs logged per fellow from 2008 to 2019 further broken down by type of repair

Robotic hernia repair adoption by program

As mentioned above, Advanced GI/MIS and Advanced GI/MIS/Bariatrics together logged the majority of robotic hernia repairs ranging from 42.7 to 94.0% (Fig. 7). Advanced GI surpassed these types of programs briefly from 2011 to 2013 but this trend did not persist (Fig. 7). A total of 101 programs logged at least one robotic hernia repair from 2008 to 2019; the remaining 22 programs did not log any robotic hernia repairs. When comparing quartiles of robotic adopters (total repairs per program, 2008–2019), there was a vast difference seen between programs in the first quartile (median of 81.0 robotic hernia repairs) and the subsequent quartiles (median 27.0, 14.0 and 1.0 robotic hernia repairs,

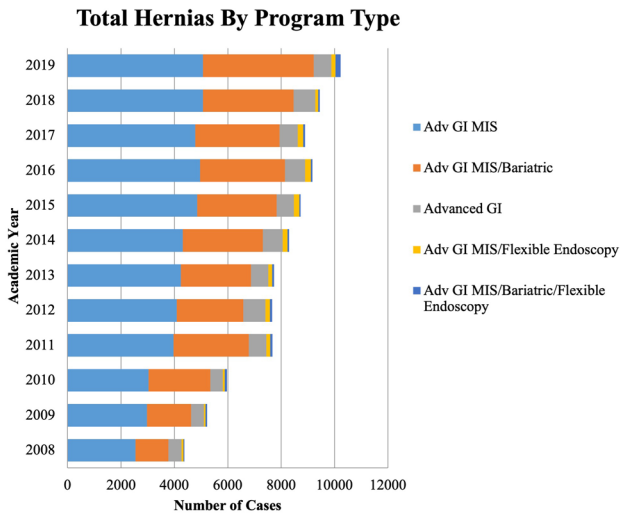

Fig. 6 The cumulative number of hernia repairs logged by program designation

Table 3 Hernia repairs by operative approach broken down by program designation

	Open[a]	Laparoscopic[a]	Robotic[a]	Total
Advanced	175–431	108–492	1–224	7865
Adv GI/MIS	625–1693	1617–2885	1–11814	49900
Adv GI/MIS/Bariatric	225–1207	1015–2144	0–1259	32965
Adv GI/MIS/Bariatrics/Flex Endo	2–29	33–96	0–63	893
Adv GI/MIS/Flex Endo	6–97	43–108	0–48	1755
Total	3247	3586	3391	93,378

MIS minimally invasive surgery, *Flex Endo* flexible endoscopy

[a]Data are displayed as a range (minimum to maximum) per academic year from 2008 to 2019

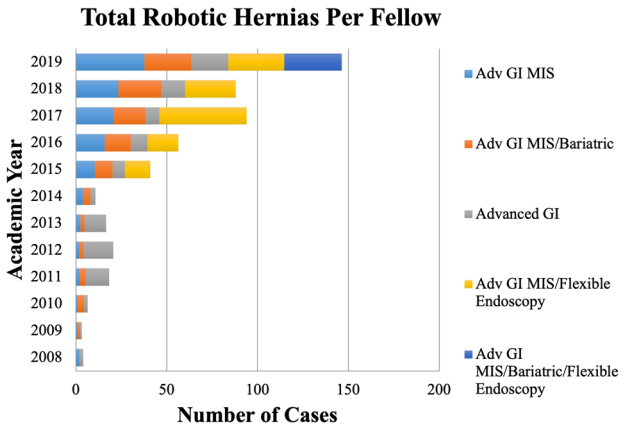

Fig. 7 The cumulative number of robotic hernia cases logged by program designation

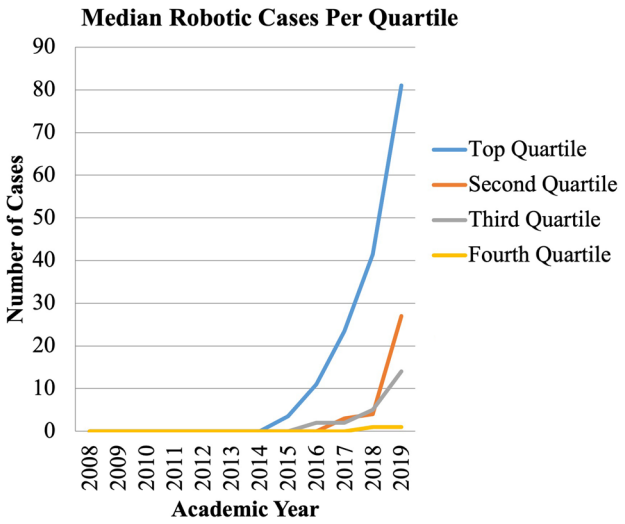

Fig. 8 The median number of robotic hernia cases performed by each quartile of adoption

respectively, Fig. 8). When looking only at the 2019 academic year and robotic hernia repairs per fellow (median cases per fellow; IQR) there was a significant difference between all quartiles: first quartile (72.0; 47.9–108.8), second quartile (25.5; 21.0–30.6), third quartile (13.0; 12.0–14.3) and fourth quartile (3.5; 0.5–5.0) (p-value < 0.05 for all comparisons, Fig. 9).

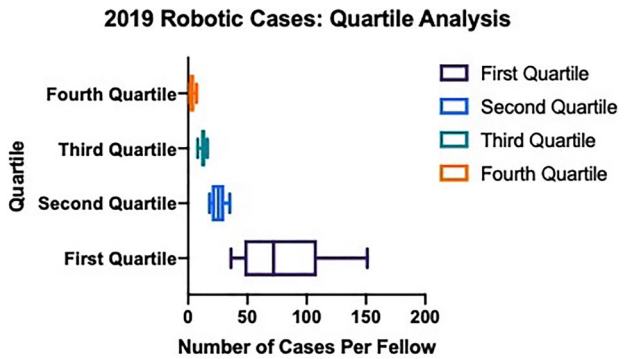

Fig. 9 Quartile of robotic repairs logged per fellow for academic year 2018–2019; $p < 0.05$ for all pairwise comparisons

Discussion

This study aimed to analyze volumes and trends in fellowship hernia repairs over the past 12 years utilizing the FC case log database to inform the creation of a hernia-specific fellowship designation. This dataset was selected based on the steady state nature of the FC case log during the years analyzed. Our analysis demonstrated findings that were both expected and surprising. The overall increasing trend in hernia repairs is reflective of previous literature demonstrating the rising incidence of hernias [1]. Furthermore, there is largely equal representation between ventral and inguinal hernia repairs, with a predominance of mesh repairs, which is consistent with the elective nature of the majority of hernia repairs [2]. Unexpected findings included the largely equal exposure across program designations and the rise in open and robotic repairs as compared to laparoscopic techniques.

Abdominal wall hernias have been increasing in prevalence across the world and put a significant burden on the healthcare system [1, 17]. These trends have been suggested to be partly due to the rising incidence of incisional hernias, the increasing complexity of hernias, and the notable recurrence rates up to 24% despite mesh repair [1, 5, 18]. Our data demonstrated a 234% growth in hernia repairs performed by FC fellows from 2008 to 2019 consistent with the growing need for hernia repairs. The demonstrated growth can be presumed to be due, in part, to the growing elective and specialty referral pattern of hernia management [2, 5].

On average, fellows were exposed to a nearly equal representation of ventral hernia repairs (52%) and inguinal hernia repairs (48%). Furthermore, the vast majority of hernias were repaired with mesh at 88%, with an even split between ventral and inguinal hernia repairs as well. This is consistent with known literature supporting the transition to mesh-based repairs to reduce recurrence rates [19, 20]. There were a surprising number of open ventral hernia repairs without mesh (27%). With the limited granularity in the case logs we can only speculate that this was due to repairs performed in emergency settings, incidental hernias found during other procedures, or the inclusion of small primary repairs. We anticipate that revisions to the FC case logs will address this shortcoming as it will include more granular data for logging cases such as the specific operative approach, mesh placement location, type of mesh, etc.

Analysis by program designation demonstrated that Advanced GI/MIS and Advanced GI/MIS/Bariatrics programs performed the vast majority of total repairs as they largely outnumbered the other program designations. When examining the repairs per fellow however, this distinction disappeared. Thus, most fellows received equal exposure across the various program designations, representing the widespread incidence of abdominal wall hernia repairs and universal exposure within the five FC designations included.

One interesting finding was the decline in the proportion of laparoscopic repairs over time as compared with the growth in both open and robotic techniques. There may have been growth in the number of complex hernias repaired using advanced open techniques such as an anterior components separation or Transversus Abdominis Release (TAR). This however cannot be substantiated given the lack of case log granularity. Starting in 2014, the decline in laparoscopic approaches was likely due to the more widespread adoption of robotic techniques, which may have replaced a substantial proportion of laparoscopic repairs. Indeed, more widespread adoption of robotic hernia repairs has also been documented for resident training [21]. Thus, our data seem to reflect these practice pattern changes.

Interestingly, there was a wide distribution in the number of repairs performed robotically within FC programs. In fact, there were 22 programs (22/123) that did not log any robotic hernia repairs for the study period. However, the rise in robotics seen in 2014 was largely represented by only a few programs that made up the first quartile of robotic adopters. These high-volume robotic programs significantly outnumber the others according to robotic cases per fellow (Figs. 8, 9). This finding is particularly important for future fellows seeking hernia-specific program designations who may specifically want robotic experience.

The authors recognize some limitations in this study. There was a limited ability to perform an in-depth analysis due a lack of granularity of the FC case log system with respect to capturing relevant data. Required case subcategories were limited to inguinal and ventral repairs and with or without mesh. Importantly, hernia complexity could not be accurately determined as secondary details were reported sparingly. For example, small umbilical hernias with mesh were logged as the same category as much more complex operations, such as a retrorectus repair. Similarly, no data were captured regarding the use of advanced techniques, such as anterior components separation or TAR; nor were data available regarding other items of interests: hernia location, loss of domain, recurrent hernias, type of mesh used, location of mesh placement, and specific repair technique. Despite these limitations, the FC case log remained consistent across the 12 academic years analyzed and provided a large amount of baseline data. Fortunately, the revised case log system implemented by the FC in 2020 is expected to provide substantially more detailed information. Additionally, during the study period, there were no discrete accreditation requirements for hernia repairs; thus, it is possible that fellows, lacking incentive, may not have logged some hernia repairs that they performed. While this occurrence would have skewed our numbers to underestimate case volumes, we suspect that the trends we detected were likely accurate. Finally, it is important to note that quantity does not necessarily equal quality. While case logs are one of the most widely used metrics for performance evaluation in surgery, newer work is being developed for other more comprehensive assessment metrics that will add to the rigor of this work.

The strength of this study was the large-scale analysis of twelve-year case log data, which demonstrated high volumes and trends of growth for hernia repairs and fellow exposure to these operations. Furthermore, data from the FC website demonstrate that hernias make up anywhere from 10 to 34% of a trainee's total procedural exposure in a given academic year [22]. This information will be useful for the FC, AHS, and SAGES to develop standards for hernia-specific fellowship designations in terms of potential feasibility regarding overall case numbers. We anticipate that the new FC case log will also allow detailed tracking of the types of operations that are being performed; importantly, this will provide

recognition of hernia-specific complexity training and further empower the creation of hernia fellowship standards.

Conclusion

This study analyzed 12 years of FC hernia case logs to assess volumes and trends of hernia repairs during fellowship experience. The data demonstrated a near doubling in the growth of total hernia repairs with largely equal representation across the included program designations. Furthermore, we detected a decrease in representation of laparoscopic approaches for all hernia repairs as open and robotic techniques increased by comparison. These data demonstrate the rising exposure to hernia repairs; however, no thresholds exist on which to certify fellows' hernia experience. Furthermore, the growing incidence and complexity of abdominal wall repairs supports the importance of specific training of our fellows. Thus, we support the development of a hernia-specific designation and expect more granular case log analysis to assist with the development of thresholds for accreditation in each technique.

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Declarations

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