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Anatomy is the key to mastery in cancer and general surgery: the results of a survey on anatomical knowledge among surgeons

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Introduction. Cancer and general surgery is a medical field in which anatomical knowledge is crucial. The anatomy taught to medical students is based on a standardized model of the body, with no regard paid to anatomical variations which can result in serious difficulties and disorientation during surgical procedures.

Material and methods. Our goal was to assess anatomical knowledge, including anatomical variations, among surgeons. The questionnaire was administered among a group of 90 surgeons (general [69.7%] and oncological [20.2%]). The mean number of years in practice in their respective field was 12.9 ± 9.3.

Results. All participants were unanimous in declaring that anatomical knowledge was required in everyday surgical practice. The responses were also consistent in describing the role of knowledge of anatomical variations, declaring it "very important" and "important" in avoiding complications (76.4%). The majority of surgeons rated their anatomical aptitude as "good" (57.3%) or "very good" (13.5%).

Conclusions. The anatomical knowledge of Polish general and cancer surgeons is satisfactory.

Key words: anatomy, professional education, surgery, anatomic variation, medical errors

Introduction

Anatomy has been an indispensable component of medical school curricula for centuries, while also being the bane of medical students' education. Anatomical education not only represents a purely academic pursuit, but it remains a rite of passage for medical students on their journey to becoming clinicians [1–3]. A fundamental knowledge of anatomy seems to be essential in virtually every aspect of the diagnostic and therapeutic process – the physical exam, the diagnosis, the treatment strategy, and effective communication among specialists [1, 4].

Surgery is a medical field in which anatomical knowledge is of the utmost importance. Each surgical procedure is inextricable from the surrounding anatomy, whether it be variations in shape, size or configurations of the corresponding structures [1, 4]. Removal of malignancy requires the highest level of

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anatomical skills to achieve radicality of dissection, including regional lymphadenectomies, regardless of the location of the primary tumor; this is critical in reconstructive surgery following oncological resection. Lack of detailed knowledge of anatomical variations is an important risk factor for suboptimal dissection and subsequently decreased overall cancer surgery efficacy [5, 6].

Given the above, it becomes unsettling to discover the emergence of weakening standards of anatomical acumen among medical students, medical graduates, and even new surgeons [3, 4, 7–11]. A declining proficiency in anatomical knowledge may inevitably lead to surgical errors, eventually impacting patient satisfaction and resulting in legal action [4, 8, 12]. The percentage of procedural errors attributed to anatomical factors is as high as 20% to 35% [13–15]. Furthermore, the anatomy taught to medical students is based on a standardized model of the body, with no regard paid to anatomical variations. Medical students are thus ill-equipped to recognize clinically relevant variations, and this dearth of knowledge can result in serious difficulties and disorientation during surgical procedures [16, 17]. Taken together, these trends are especially disconcerting given that the field of medicine, including surgery, is evolving toward increasingly specialized disciplines that will require more training and knowledge in anatomy than previous generations of medical doctors [18]. Given the reports in foreign publications on the declining level of anatomical knowledge among surgeons, especially those new to the field, it was worth investigating the situation in Poland to address the lack of similar studies conducted in our country.

The main goal of our study was to assess the level of anatomical skills, including knowledge of anatomical variations, among surgeons.

Material and methods

Survey design

The study was conducted through an online questionnaire. The questionnaire was comprised of two parts. The first part involved open and closed questions, with both multiple choice and single choice (formulated according to the 5-item Likert scale) questions aimed at assessing the characteristics of the studied group and collecting feedback on the subjectively assessed utility of anatomical knowledge in everyday surgical practice including the most often consulted resources for anatomical information. The second part of the questionnaire was an evaluation of anatomical knowledge consisting of 8 multiple choice questions with a single correct answer; questions were referring to specific anatomical issues. The questionnaire (in Polish) is attached as supplementary material.

Survey administration

The questionnaire was distributed by e-mail and shared on social media platforms, including closed groups for surgeons only, between August and December 2020.

Statistical analysis

All data were analysed with Statsoft STATISTICA v.13. The results are presented as mean ± standard deviation (SD) or median with quartiles, when appropriate. The Shapiro-Wilk test was used to check for normal distribution of data. In the cases of quantitative variables, where no normal distribution was observed and when other requirements were not met, we used the Kruskal-Wallis or the Mann-Whitney U test depending on the number of subgroups. The results were considered statistically significant when the p-value was found to be less than 0.05.

Results

The questionnaire was administered among a group of 90 surgeons. One of the responders was excluded from analysis owing to the fact that their declared age and field of work was found to be factually inconsistent; thus, the final number of questionnaires analyzed was 89.

The study participants consisted mainly of general surgeons (69.7%) and oncological surgeons (20.2%) with varying years of experience. The mean number of procedures among general surgeons was found to be 197 ± 168.1, 252.3 ± 156.6 procedures among oncological surgeons, and 101.7 ± 55.6 procedures among the remaining participants. The mean number of years in practice in their respective fields was 12.9 ± 9.3 years. General surgeons reported 11.7 ± 9.0 years of experience in their field, while oncological surgeons reported 16.8 ± 9.9 year, and other surgeons reporting 14.4 ± 7.9 years. The cohort consisted of 23 (25.8%) women and 66 (74.2%) men. The mean age was 38.9 ± 9.2 years of age; the mean age of the female participants (34.3 ± 4.8 years) was significantly ($p = 0.0046$) different from their male counterparts (40.5 ± 9.8). The youngest respondent was 27 years old, while the most senior was 70 years old. The mean number of procedures performed in a year among the studied population was 199 ± 161.7. When separated by sex, the mean number of procedures performed among men was 202 ± 162.9 and 189.0 ± 161.8 among woman. The respondents were workers of university-affiliated institutions (39.3%), district hospitals (30.3%), and provincial hospitals (24.7%). Characteristics of respondents are included in table I.

All participants were unanimous in declaring that anatomical knowledge was required in everyday surgical practice, with 86.5% selecting "essential", and 13.5% selecting "useful". The responses were also consistent in describing the role of knowledge of anatomical variations in a given structure, declaring it "very important" and "important" in avoiding surgical complications (76.4%) or acknowledging that "anatomical variations are worth knowing" (23.6%). When asked about the nature of anatomical variants considered most important in their training, the study participants specified venous and organ variants (fig. 1).

As a main source of information for broadening their anatomical acumen, respondents most often endorsed manuals and atlases (92.1%), followed by multimedia resources which includes but is not limited to videos or virtual reality, (74.2%)

Table I. Group characteristics

Number of responders (n = 89), (%)	
• females, n (%)	23 (25.8%)
• males, n (%)	66 (74.2%)
mean age, years ± SD	38.9 ± 9.2
number of years worked in the profession, years ± SD	12.9 ± 9.3
Surgical field	
• general surgery	62 (69.7%)
• oncological surgery	18 (20.2%)
• others	9 (10.1%)
mean number of operations performed per year ± SD	199 ± 161.7
Workplace	
• university hospital	36 (39.3%)
• provincial hospital	22 (24.7%)
• district hospital	27 (30.3%)
• others	5 (5.6%)

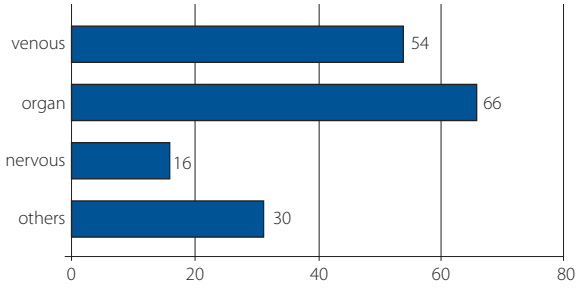

Figure 1. Which of the following classes of anatomical variations were includes in the program of your training so far? (More than one answer possible)

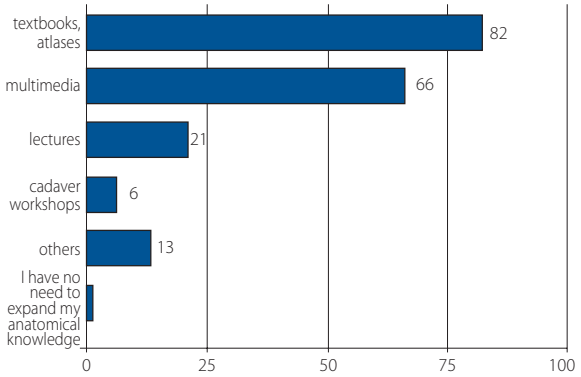

Figure 2. What sources do you mainly use to expand your knowledge of anatomy? (Multiple answers possible)

and cadaveric workshops (6.7%) (fig. 2). Among those who endorsed these workshops as a source of anatomical knowledge, the median score on the anatomical knowledge test was 4 (range 3 to 7), while the median score for those who did not make use of anatomical workshops was 5 (range 4 to 6).

The majority of surgeons rated their anatomical aptitude as "good" (57.3%) or "very good" (13.5%). 28.1% of respondents rated their knowledge as "neither good, nor bad" and only one as "bad" (1.1%). The amount of points earned on the anatomical skills evaluation did not differ among the respective groups who self-assessed their anatomical knowledge – the median was 5 points (for a maximum of 8 possible points on a knowledge assessment).The individuals in the group who assessed their anatomical knowledge as "very good" earned a slightly higher median score of 6 (tab. II). The mean amount of points earned on the evaluation of anatomical knowledge was 5.9 ± 1.64. These details are presented in table III (note that questions 1–8 in table III correspond to questions 12–19 in the questionnaire). No statistically significant difference was found in the number of points earned on the evaluation of anatomical knowledge among the groups specified by sex ($p = 0.958$), surgical specialty ($p = 0.235$), place of work ($p = 0.1428$), years of experience (less than or more than 10 years of experience) ($p = 0.7563$) or the approximate number of procedures performed within a year (less than or more than 100 procedures per year) ($p = 0.6849$) (tab. IV).

Discussion

The main findings of this study include the consensus among Polish general and oncological surgeons that knowledge of anatomy and its variations is important in their surgical practice, and that their main sources of knowledge are atlases and manuals, as well as medical multimedia resources. Most Polish surgeons self-assessed their own knowledge as either good or very good, with those in the latter group earning a slightly higher median score on the knowledge test. However, factors such as sex, surgical specialty, and years of experience had no significant effect on the results of the knowledge test.

Many studies have described the declining standard of foundational anatomical knowledge among surgeons and students [3, 4, 7–11]. Concurrently, there also exists a growing number of legal claims attributed to surgical errors, which cite insufficient knowledge as a contributing factor to the error [13–15, 19]. In the context of these well-established claims, it can be surmised that the level of anatomical knowledge among Polish surgeons is satisfactory, regardless of whether

Table II. Results of the anatomical knowledge test in accordance with belonging to the groups of anatomical knowledge self-assessment

	Number of responders (%)	Median sum (IQR)
very good	12 (13.5%)	6 (5.5–6.5)
good	51 (57.3%)	5 (4–6)
neither good nor bad	25 (28.1%)	5 (4–6)
bad	1 (1.1%)	5 (5–5)
very bad	–	–

Table III. The number of correct answers obtained in the anatomical knowledge test in each group

Correct answer								
	Question 1 [Question about the blood vessels of the liver]	Question 2 [Question about the portal vein]	Question 3 [Question about the gallblader]	Question 4 [Question about visceral vascularization]	Question 5 [Question about vascularization of the large intestine]	Question 6 [Question about anatomy of the duodenum]	Question 7 [Question about the arc of Buhler]	Question 8 [Question about the clinical significance of the arc of Buhler]
all, n (%)	70 (78.7%)	69 (77.5%)	67 (75.3%)	68 (76.4%)	38 (42.7%)	56 (62.9%)	62 (69.7%)	23 (25.8%)
sex								
females, n (%)	19 (82.6%)	15 (65.2%)	19 (82.6%)	19 (82.6%)	9 (39.1%)	15 (65.2%)	17 (73.9%)	5 (21.7%)
males, n (%)	51 (77.3%)	54 (81.8%)	48 (72.7%)	49 (74.2%)	29 (43.9%)	41 (62.1%)	45 (68.2%)	18 (27.3%)
surgical field								
general surgery	46 (74.2%)	48 (77.4%)	47 (75.8%)	48 (77.4%)	23 (37.1%)	37 (59.7%)	40 (64.5%)	14 (22.6%)
oncological surgery	17 (94.4%)	15 (83.3%)	16 (88.9%)	16 (88.9%)	10 (55.6%)	11 (61.1%)	15 (83.3%)	6 (33.3%)
others	7 (77.8%)	6 (66.7%)	4 (44.4%)	4 (44.4%)	5 (55.6%)	8 (88.9%)	7 (77.8%)	3 (33.3%)
workplace								
university hospital	29 (92.9%)	26 (75.3%)	25 (71.4%)	28 (80%)	17 (48.6%)	23 (65.7%)	25 (71.4%)	9 (25.7%)
provincial hospital	15 (68.2%)	18 (81.8%)	18 (81.8%)	13 (59.1%)	7 (31.8%)	11 (50%)	16 (72.7%)	5 (22.7%)
district hospital	21 (77.8%)	21 (77.8%)	19 (70.4%)	22 (81.5%)	12 (44.4%)	19 (70.4%)	17 (59.3%)	7 (25.9%)
others	5 (100%)	4 (80%)	5 (100%)	5 (100%)	2 (40%)	3 (60%)	5 (100%)	2 (40%)

Table IV. The average number of points obtained in the anatomical knowledge test in each group

Median sum (IQR)		p
females, n (%)	5 (4–6)	0.958
males, n (%)	5 (4–6)	
general surgery	5 (4–6)	0.235
oncological surgery	6 (5–7)	
others	5 (4–6)	
university hospital	5 (4–6)	0.1428
provincial hospital	6 (3–6)	
district hospital	5 (4–6)	
others	6 (6–7)	
>10 years of work	5 (4–6)	0.7563
<10 years of work	5 (4–6)	
approximate number of surgical procedures per year >100	5 (4–6)	0.6849
approximate number of surgical procedures per year <100	5 (4–6)	

he or she is beginning their career or has years of experience. In cancer surgery anatomical crucial landmarks and anatomical variations are of utmost importance, as the extent of cancer resection includes typically regional lymph nodes [5, 6] and often encompasses neighboring organs (multiorgan *en-bloc* resections). Appropriate care for oncological radically from one side and preservation of blood supply to the organs left in situ requires detailed anatomical aptitude; specific knowledge of anatomy is required in organ-sparing cancer surgery [20].

A very small subset of respondents in this study was found to take advantage of cadaveric workshops, which is in contrast to the results of studies conducted outside of Poland [9, 17]. Such workshops are considered to be the most effective method of learning anatomy [1, 4, 7, 17]. There was no statistically significant difference in test results between those participants who participated in cadaveric workshops and those who did not. Although other studies have described the advantage of these workshops, the lack of statistically significant results in our research could be due to the small sample size. This discrepancy may also be attributed to a lack of access to these resources in our country.

While the majority of respondents were able to give the correct answer (69.7% answered correctly) on an anatomical variant (question 7), the task of describing its clinical significance (question 8) proved to be more difficult, with 25.8% of respondents answering correctly. Given these findings, it may be worth investing in resources that can expand surgeons' knowledge of anatomical variants.

Limitations

This study was limited by the number of surgeons who were able to respond to the questionnaire. A more rigorous asses-

sment of anatomical knowledge could also be used to more accurately determine each participant's acumen.

Conclusions

According to the authors' knowledge, this is the first study of its kind conducted in Poland. To extract broader conclusions, it would be worthwhile to expand the number of study participants, and to administer a more advanced evaluation of anatomical knowledge. From this study, the authors can ascertain that the anatomical knowledge of Polish general and cancer surgeons is satisfactory. It may be beneficial to provide surgeons-in-training with access to cadaveric workshops, as this resource has been found to be the most effective method of learning anatomy, yet as this study has found, only a minority of the respondents take advantage of such opportunities. Finally, post-graduate medical education programs should consider placing more emphasis on anatomical variants as well as their clinical correlations, particularly for surgeons dealing with cancer patients, in whom it is often required to perform non-anatomical, multiorgan or – contrary – organ-preserving surgery, which requires the very highest level of anatomical mastery.

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References

1. Turney BW. Anatomy in a modern medical curriculum. Ann R Coll Surg Engl. 2007; 89(2): 104–107, doi: 10.1308/003588407X168244, indexed in Pubmed: 17346399.
2. Netterstrøm I, Kayser L. Learning to be a doctor while learning anatomy! Anat Sci Educ. 2008; 1(4): 154–158, doi: 10.1002/ase.31, indexed in Pubmed: 19177402.
3. Staśkiewicz GJ, Walczak E, Torres K, et al. What do clinicians think of the anatomical knowledge of medical students? Results of a survey. Folia Morphol (Warsz). 2007; 66(2): 138–142, indexed in Pubmed: 17594673.
4. Singh R, Tubbs R. Should a Highly Skilled Surgeon be an Advanced Anatomist first? - A View Point. Basic Sciences of Medicine. 2015; 4(4): 53–57, doi: 10.5923/j.medicine.20150404.01.
5. Wysocki W, Libondi G, Juszczak A. Surgical anatomy of the breast revisited. Nowotwory J Oncol. 2020; 70(1): 26–28, doi: 10.5603/njo.2020.0005.
6. Cieśla S, Wichtowski M, Poźniak-Balicka R, et al. The surgical anatomy of the mammary gland. Vascularisation, innervation, lymphatic drainage, the structure of the axillary fossa (part 2. Nowotwory J Oncol. 2021; 71(1): 62–69, doi: 10.5603/NJO.2021.0011.
7. Waterston SW, Stewart IJ. Survey of clinicians' attitudes to the anatomical teaching and knowledge of medical students. Clin Anat. 2005; 18(5): 380–384, doi: 10.1002/ca.20101, indexed in Pubmed: 15971223.
8. Sharma G, Aycart MA, Najjar PA, et al. A cadaveric procedural anatomy course enhances operative competence. J Surg Res. 2016; 201(1): 22–28, doi: 10.1016/j.jss.2015.09.037, indexed in Pubmed: 26850180.
9. Mattar SG, Alseidi AA, Jones DB, et al. General surgery residency inadequately prepares trainees for fellowship: results of a survey of fellowship program directors. Ann Surg. 2013; 258(3): 440–449, doi: 10.1097/SLA.0b013e3182a191ca, indexed in Pubmed: 24022436.
10. Tayyem R, Qandeel H, Qsous G, et al. Medical Students' vs. Consultant Surgeons' View of Anatomy Knowledge. International Journal of Morphology. 2019; 37(4): 1475–1479, doi: 10.4067/s0717-95022019000401475.
11. Cottam WW. Adequacy of medical school gross anatomy education as perceived by certain postgraduate residency programs and anatomy course directors. Clin Anat. 1999; 12(1): 55–65, doi: 10.1002/(SICI)1098-2353(1999)12:1<55::AID-CA8>3.0.CO;2-O, indexed in Pubmed: 9890730.
12. Goodwin H. Litigation and surgical practice in the UK. Br J Surg. 2000; 87(8): 977–979, doi: 10.1046/j.1365-2168.2000.01562.x, indexed in Pubmed: 10931037.
13. Rogers SO, Gawande AA, Kwaan M, et al. Analysis of surgical errors in closed malpractice claims at 4 liability insurers. Surgery. 2006; 140(1): 25–33, doi: 10.1016/j.surg.2006.01.008, indexed in Pubmed: 16857439.
14. Somville FJ, van Sprundel M, Somville J. Analysis of surgical errors in malpractice claims in Belgium. Acta Chir Belg. 2010; 110(1): 11–18, doi: 10.1080/00015458.2010.11680558, indexed in Pubmed: 20306903.
15. Regenbogen SE, Greenberg CC, Studdert DM, et al. Patterns of technical error among surgical malpractice claims: an analysis of strategies to prevent injury to surgical patients. Ann Surg. 2007; 246(5): 705–711, doi: 10.1097/SLA.0b013e31815865f8, indexed in Pubmed: 17968158.
16. Raikos A, Smith JD. Anatomical variations: How do surgical and radiology training programs teach and assess them in their training curricula? Clin Anat. 2015; 28(6): 717–724, doi: 10.1002/ca.22560, indexed in Pubmed: 25974002.
17. Henry BM, Tomaszewski KA, Walocha JA. Methods of Evidence-Based Anatomy: a guide to conducting systematic reviews and meta-analysis of anatomical studies. Ann Anat. 2016; 205: 16–21, doi: 10.1016/j.aanat.2015.12.002, indexed in Pubmed: 26844627.
18. Ahmed K, Rowland S, Patel V, et al. Is the structure of anatomy curriculum adequate for safe medical practice? Surgeon. 2010; 8(6): 318–324, doi: 10.1016/j.surge.2010.06.005, indexed in Pubmed: 20950770.
19. Ellis H. Medico-legal Litigation and its Links with Surgical Anatomy. Surgery (Oxford). 2002; 20(8), doi: 10.1383/surg.20.8.0.14518.
20. Zubaryev M, Kim HS, Min BS. Local excision vs. radical surgery in treating rectal nets considering the biology of neuroendocrine tumors (NETs). Nowotwory J Oncol. 2021; 71(1): 9–16, doi: 10.5603/njo.a2021.0001.