Nerve Surgeons' Assessment of the Role of Eduard Pernkopf's *Atlas of Topographic and Applied Human Anatomy* in Surgical Practice

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Pernkopf's Atlas of Anatomy contains anatomical plates with detailed images of the peripheral nerves. Its use is controversial due to the author's association with the "Third Reich" and the potential depiction of victims of the Holocaust. The ethical implications of using this atlas for informing surgical planning have not been assessed. Our objectives were: (1) assess the role of Pernkopf's atlas in nerve surgeons' current practice, and (2) determine whether a proposal for its ethical handling may provide possible guidance for use in surgery and surgical education.

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BACKGROUND: Pernkopf's atlas of anatomy contains anatomical plates with detailed images of the peripheral nerves. Its use is controversial due to the author's association with the "Third Reich" and the potential depiction of victims of the Holocaust.

The ethical implications of using this atlas for informing surgical planning have not been assessed.

OBJECTIVE: To (1) assess the role of Pernkopf's atlas in nerve surgeons' current practice and (2) determine whether a proposal for its ethical handling may provide possible guidance for use in surgery and surgical education.

METHODS: Members of American Society for Peripheral Nerve and PASSIO Education (video-based learning platform) were surveyed and 182 responses collected. The survey introduced the historical origin of Pernkopf's atlas, and respondents were asked whether they would use the atlas under specific conditions to serve as a recommendation for its ethical handling. An anatomical plate comparison between Netter's and Pernkopf's atlases was performed to compare anatomical accuracy and surgical utility.

RESULTS: Fifty-nine percent of respondents were aware of Pernkopf's atlas, with 13% currently using it. Aware of the historical facts, 69% were comfortable using the atlas, 15% uncomfortable, and 17% undecided. Additional information on conditions for an ethical approach to the use of the atlas led 76% of those "uncomfortable" and "undecided" to becoming "comfortable" with use.

CONCLUSION: While the use of Pernkopf's atlas remains controversial, a proposal detailing conditions for an ethical approach in its use provides new guidance in surgical planning and education.

KEYWORDS: Pernkopf, Surgery, Ethics, Anatomy Atlas, Anatomical Illustration, Nerve

INTRODUCTION

Eduard Pernkopf's Atlas of Topographical and Applied Human Anatomy¹ was first published in its German version between 1937 and 1960, and the first American version in 1963. Publication ceased in 1994 due to the revelation in the mid-1980s and 1990s of the author's participation in the National Socialist (Nazi) regime and the possible use of executed victims from the Third Reich.¹⁻⁸ The atlas was widely known by anatomists and surgeons for its intricacy and "regional stratigraphic" approach, which involves multiple layers of dissection from superficial to deep, with an emphasis on fascial relationships that are often missing from comparable anatomical atlases.⁹ Because of its historical connection with the criminal Nazi regime, Pernkopf's atlas has been the basis of ethics discussions surrounding its use as teaching material in the anatomical sciences,¹⁰⁻¹³ but continues to circulate as a used book, and is anecdotally known for providing anatomical utility in some surgical communities. This presents ethical challenges for its use in patients who need complex surgery.¹⁴ The purpose of this study is to (1) assess the role of Pernkopf's atlas in nerve surgeons' current practice and (2) determine whether an ethical proposal to highlight the history of the atlas could provide possible guidance for its use in surgery and surgical education.

Eduard Pernkopf (1888-1955) and the atlas's illustrators were devoted members of the Nazi party (*Nationalsozialistische Deutsche Arbeiterpartei*) and/or soldiers in World War II.⁸ Pernkopf, the Director of the Viennese Anatomical Institute, was appointed as Dean of the Medical Faculty in 1938, directly after the annexation of Austria by Nazi Germany, and served as President of the University of Vienna from 1943 to 1945.⁶ In his role as Dean, he oversaw the dismissal of 157 of the 197 members of the medical faculty. Most emigrated, some died at their own hand or were murdered in concentration

camps.¹⁵ The medical illustrators demonstrated their Nazi allegiance by including Swastikas and lightning-bolt SS (*Schutzstaffel*) symbols in their signatures on the paintings.⁸ Pernkopf's and the illustrators' significant Nazi involvement was confirmed in an investigation of the origin of the bodies depicted in the paintings, which was authorized by the Senate of the University of Vienna in 1998.³

This Senatorial Project was designed to resemble an earlier historical self-assessment by an anatomical institute (University of Tübingen) with the objectives to (1) investigate the origin and destiny of the bodies used by Pernkopf and (2) to determine the extent of his Nazi party membership and political activities.⁵ The findings of the Senatorial Project revealed that 3964 bodies of adults were unclaimed, 7 donated, and at least 1377 bodies were executed prisoners, who were victims of the Nazis' unjust legislation. There was no evidence that bodies were sourced from concentration camps close to Vienna, despite such bodies being transported to a different Austrian anatomical institute.^{4,5} Of the 791 illustrations produced for the atlas, 41 plates were definitively based on the bodies of executed victims, with the origin of approximately 350 plates remaining unclear.⁴ While traditional, legal anatomical body procurement included unclaimed bodies from public institutions, among them executed prisoners and persons who committed suicide, the number of executions rose exponentially under the Nazi regime due to new legislation.¹⁶

Because of this history, the use of Pernkopf's atlas for complex surgical planning presents significant ethical challenges.^{13,14} Furthermore, an assessment of the current role of the atlas in a surgeon's practice does not exist. This study represents a focused assessment in nerve surgery due to the intricate portrayal of complex nerve anatomy in Pernkopf's atlas. While anatomical atlases vary widely with respect to detail, dissection, topography, artistic rendition, and overall design,^{2,17-24} Pernkopf's atlas has been considered as a "masterpiece" in the

anatomical sciences, even if indeed a "troubled masterpiece."⁸

A goal of this investigation is to assess whether Pernkopf's atlas provides anatomical accuracy and surgical utility, as judged by nerve surgeons, in comparison with another prominent atlas (*Netter's Atlas of Human Anatomy*¹⁹) through a visual plate comparison.²⁵ In a next step, surgeons were informed about a proposal for a potential ethically justified use of Pernkopf's atlas and asked, if this information would change their decision to "use" or "not to use" the atlas. This proposal is based on recent discussions on the handling of human remains and data from the Holocaust era, discussions that included the Pernkopf paintings.²⁶⁻²⁸ The findings from this study serve as a recommendation from nerve surgeons for the ethical handling of Pernkopf's atlas in surgery.

METHODS

Selection and Description of Participants

An electronic questionnaire was designed using an online survey tool (SurveyGizmo, (<https://www.surveygizmo.com>)) and distributed via email to members of the American Society for Peripheral Nerve (ASPN) and PASSIO Education (<https://www.passioeducation.com/>). PASSIO Education is an online video-based learning program/platform for international nerve surgeons. Data were collected from April 10, 2017 through July 7, 2017. Recruitment of participants was performed by an initial email invitation to each group (ASPN, PASSIO), followed by 2 reminder emails before the survey was closed. No incentives for survey participation were offered. This study (#201702009) was approved by the Institutional Review Board of Washington University School of Medicine in St. Louis, Missouri.

Survey Design

The survey was composed of 2 parts: (1) surgical assessment and ethical handling of Pernkopf's atlas

and (2) demographics, anatomical resources, and anatomical plate comparisons. The first part included a maximum of 11 questions with embedded survey logic to prevent exposure of repeated questions to reduce survey fatigue. Respondents were exposed to the historical findings of the Senatorial Project for assessment.³⁻⁵ Special consideration was given to avoid exposure to Pernkopf illustrations for individuals who responded as being "uncomfortable" with the use of the atlas. Following the assessment, participants were given a scenario for a decision to "use" or "not to use" if certain ethical conditions were met. A "4-point proposal" was developed, which includes (1) formal disclosure discussing the historical origin and ethical challenges, (2) consensus from bioethicists validating its specific use for benefiting the lives of patients, (3) consensus from *BetDin* (Jewish religious rabbinical court) that is consistent with the Jewish principle, *Piku'ach nefesh*, which describes, under certain conditions, the preservation of human life overrides any other religious consideration,²⁷ and (4) an official memorial commemorating the victims portrayed in the atlas. Responses from the previous assessment were compared to responses following the 4-point proposal to determine its effectiveness.

The second survey part included a maximum of 10 demographic and 2 anatomical resource questions and 6 plate comparisons. Six plates were selected,²⁵ each from Netter's and Pernkopf's atlases^{1,19} that demonstrated comparable structures, anatomical orientation, and relevance to nerve surgery to ensure a standardized comparison. Images were scanned at high-resolution, identifiable labels removed, and "white-balanced" to ensure proper image quality. Before the plate comparison, participants underwent a descriptive tutorial with an optional video and logic question to ensure the appropriate computer skill to view both Netter's and Pernkopf's plate. Netter's and Pernkopf's plates were randomized with either left or right positioning in each comparison. An estimated length of 12 minutes was calculated for completion of the entire survey.

Statistical Analysis

All statistical analyses (*P*-values) on the plate comparison data were performed using SPSS Statistical Software (version 23, IBM, Armonk, New York). Proportions of surgeons, who perceived images as having greater anatomical accuracy and greater surgical utility, were given the null hypothesis of 50/50.

RESULTS

Demographics

One hundred eighty-two responses were collected (25% response rate, 77% completion rate, 35% ASPN, 65% PASSIO). Of the respondents, 83% were male and 17% female; ages ranged from 26 to 73 yr old; 16% were resident physicians, 12% surgical fellows, and 72% practicing surgeons. Additional demographic data pertaining to continent-of-origin, race, religious beliefs, surgical specialty, and years-of-practice were obtained (Table 1).

Awareness and Usage of Pernkopf's Atlas in Nerve Surgery

Of the respondents, 59% were aware of Pernkopf's atlas. Of those aware, 41% had used it previously; 22% were currently using it; 77% were aware of the atlas's historical origin (Table 2). Of those historically aware of the origin of the atlas, 66% reported "some general knowledge" concerning the abusive actions of German physicians during the Third Reich with 10% and 24%, respectively, reporting having "very little" or a "great deal" of knowledge. These numbers are similar for practicing surgeons and trainees, except for 31% of practicing surgeons reporting knowing a "great deal" compared to only 6% of trainees.

TABLE 1. Demographics of Survey Respondents	
Societies	Proportion (%)
American Society for Peripheral Nerve (ASPN)	35
PASSIO Education (PASSIO, passioeducation.com)	65
Gender	Proportion (%)
Male	83
Female	17
Age	Years
Age	26-73 (avg. 43)
Continent of Origin	Proportion (%)
North America	45
South America	5
Europe	27
Asia	16
Africa	5
Australia	2
Race	Proportion (%)
Asian	13
Black	1
East Indian	2
Latino/Hispanic	8
Middle Eastern	9
White	63
Biracial	1
Multiracial	4
Other	1
Religious Beliefs	Proportion (%)
Agnostic	14
Atheist	11
Buddhist/Taoist	2
Christian (Catholic, Orthodox, Protestant, Latter Day Saints, Other)	39
Hindu	4
Jewish	13
Muslim/Islam	10
Spiritual	4
Prefer Not to Answer	1
Other	2
Position	Proportion (%)
Resident or Fellow Surgeon	28
Practicing Surgeon	72
Surgical Specialty/Practice Type	Proportion (%)
Hand Surgery	55
Neurological Surgery	19
Orthopedic Surgery	28
Plastic and Reconstructive Surgery	45
Other	7
Practice Duration	Years
Years-in-Practice	1-39 (avg. 14)

TABLE 2. Survey Responses on the use or Not to Use Pernkopf's Atlas in Nerve Surgery

Survey Questions	Total n = 182		Practicing Surgeons n = 108		Surgical Trainees n = 42		Jewish n = 20	
	Yes	No	Yes	No	Yes	No	Yes	No
Are you aware of Eduard Pernkopf’s Atlas of Topographical and Applied Human Anatomy?	59%	41%	57%	43%	52%	48%	65%	35%
L Have you previously used Pernkopf’s atlas?	41%	59%	45%	55%	41%	59%	39%	62%
L Are you currently using Pernkopf’s atlas?	22%	79%	23%	77%	18%	82%	8%	92%
L Are you aware of the history behind the creation of Pernkopf’s atlas?	77%	23%	77%	23%	82%	18%	92%	8%
Little, some, great deal								
L What is your level of knowledge concerning the improper actions of some German physicians during the Third Reich?	10%, 66%, 24%		8%, 60%, 31%		17%, 78%, 6%		0%, 42%, 58%	
	Yes	No	Yes	No	Yes	No	Yes	No
L Do you prefer to use an alternative anatomical resource because of your knowledge of the history of Pernkopf’s atlas?	29%	71%	35%	65%	6%	94%	75%	25%
Historical Presentation of Pernkopf’s Atlas of Topographical and Applied Human Anatomy								
Yes, undecided, no								
Based upon this information, would you be comfortable using Pernkopf’s atlas as a reference material?	69%, 17%, 15%		62%, 18%, 20%		81%, 17%, 2%		40%, 15%, 45%	
Would you use Pernkopf’s atlas if which of the following conditions are met:	Use	Not Use	Use	Not Use	Use	Not Use	Use	Not Use
L A formal and educational disclosure displayed prior to viewing the atlas discussing its historical origin and ethical discussion.	38%		32%		55%		25%	
L A consensus from bioethicists validating its specific use for benefiting the lives of patients.	31%		25%		38%		10%	
L A consensus validating its use from Bet Din (Jewish religious rabbinical court) and consistent with the Jewish ethical principle of <i>Pikeuach Nafesh</i> in that preservation of human life overrides virtually any other religious consideration.	17%		14%		24%		15%	
L An official memorial existed, which was dedicated to the victims of the atlas.	20%		16%		29%		15%	
L All of the above.	22%		22%		19%		30%	
L None of the above. I would use Pernkopf’s atlas regardless of the above conditions.	29%		32%		19%		10%	
L None of the above. I would NOT use Pernkopf’s atlas	6%		8%		0%		25%	
Comfortable, undecided, uncomfortable, no opinion								
^a Given the controversial history of Pernkopf’s atlas and having met all ethical and moral conditions provided above, how would you feel about specific Pernkopf’s plates to accompany a surgical education resource as important anatomical landmarks with specific conditions?	81%, 8%, 6%, 6%		77%, 7%, 10%, 6%		88%, 5%, 0%, 7%		47%, 13%, 27%, 7%	
Yes, undecided, no								
^b Given the controversial history of Pernkopf’s atlas and having met all ethical and moral conditions provided above, would you allow for the specific use of the atlas by other surgeons in the treatment of patients with devastating nerve injuries?	33%, 11%, 56%		33%, 22%, 44%		No responses		20%, 60%, 20%	

Table 2 Key: L - Survey logic, which displays the question to the participant based on the previous proper question (e.g., "yes" to the "awareness" question displays the question of "previous use"). Therefore, denoted survey answers are a subpopulation of the previous proper question (e.g., "41% yes" to "previous use" question is a subpopulation of the "59% yes" of the "awareness" question).

a Survey logic specific to the "use" group.

b Survey logic specific to the "not use" group.

Influence of a 4-Point Ethical Proposal

Following an explanation of the history surrounding Pernkopf's atlas, 69% of respondents felt comfortable using it as reference material, with 17% undecided and 15% uncomfortable (Figure). Respondents were then asked if they would use Pernkopf's atlas under any of 4 ethical conditions: (1) 38% would "use" the atlas in conjunction with a formal and educational disclosure prior to viewing the atlas, (2) 31% with having a consensus from bioethicists validating its use to benefit patient care, (3) 17% after a *Bet Din* consensus validating *Piku'ach nefesh*,²⁷ (4) 20% with having an official memorial commemorating the victims of the atlas, and 22% with having met all of the above conditions; 29% of respondents would use Pernkopf's atlas regardless of those conditions; and finally 6% of respondents would not use Pernkopf's atlas irrespective of those conditions. Of the respondents who were initially "undecided" or "uncomfortable" in using the atlas, 93% and 59%, respectively, changed their decision to "use" of the atlas following the 4-point proposal, with an average of 76%.

Surgical Education and Use by Others to Benefit Patients with Nerve Injuries

Respondents who were comfortable with the use of the atlas following the 4-point proposal were then asked whether the images could be used to teach important anatomical landmarks alongside the surgical videos on PASSIO Education (<https://surgicaleducation.wustl.edu/category/surgical-procedures/>) if the following conditions were met: (1) no financial profit would be made from the images, (2) the images could not be downloaded, (3) full disclosure in a preface documenting the historical origin and ethical challenges of Pernkopf's atlas, and (4) a hyperlink to the official information and memorial relating to the atlas; 81% reported being comfortable, 8% undecided, 6% uncomfortable, and 6% no opinion. Respondents who would not use the atlas despite the 4-point proposal were asked whether they would allow other surgeons to use the atlas to benefit patients with

devastating nerve injuries; 33% reported yes, 56% no, and 11% were undecided.

TABLE 3. Type of Anatomical Resources Used in Nerve Surgery

Type of Anatomical Resources Used	Proportion
Anatomical Atlases	81%
Specialized Surgical Textbooks	86%
Original Research & Clinical Journal Articles	65%
Societal Educational Resources	29%
Internet Resources	76%
Other	4%

Responses from Surgeons of Jewish Descent

Respondents who identified as being of Jewish descent (n=20, 13%) were analysed independently on their awareness, usage, and influence of the 4-point proposal. This step was taken because Jews were the main target of Nazi extermination policies in the Holocaust and thus potentially most affected by the use of the atlas.^{29,30} Of the respondents with

TABLE 4. Type of Anatomical Atlases Used in Nerve Surgery

Type of Anatomical Atlases Used	Proportion
Netter's Atlas of Human Anatomy	81%
Gray's Atlas of Anatomy	50%
Grant's Atlas of Human Anatomy	33%
Sobotta's Atlas of Human Anatomy	24%
Thieme's Atlas of Anatomy	14%
Pernkopf's Atlas of Topographical and Applied Human Anatomy	13%
Rohen's Photographic Color Atlas of Anatomy	12%
Other	11%
Lippincott Williams & Wilkins' Atlas of Anatomy	7%
Morris' Human Anatomy: A Complete Systematic Treatise	1%

Jewish descent, 13 (65%) were aware of Pernkopf's atlas. Of those aware, 5 (39%) had used it previously; 1 (8%) was currently using it, and 12 (92%) were aware of the atlas's historical origin. Of those historically aware of the origin of the atlas, 58% reported knowing a "great deal" concerning the abusive actions of German physicians during the Third Reich, with the remaining 42% having "some general knowledge." Following a historical explanation of Pernkopf's atlas, 40% felt comfortable using it as reference material, with 15% undecided and 45% uncomfortable. Respondents

TABLE 5. Netter's vs Pernkopf's Anatomical Plate Comparison

Anatomical Plate Description	Plate		Greater Anatomical Detail			Greater Surgical Utility		
	P	N	Pernkopf	Netter	P-value	Pernkopf	Netter	P-value
Facial nerve and distal branches.	140	20	91%	5%	$P < .001$	82%	14%	$P < .001$
Spinal accessory, brachial plexus, and phrenic nerves.	285	28	90%	6%	$P < .001$	75%	21%	$P < .001$
Axillary nerve and its superior lateral cutaneous branch in relation to the radial nerve.	50	415	86%	7%	$P < .001$	82%	13%	$P < .001$
Palmar and digital cutaneous branches of the median and ulnar nerves.	77	443	82%	6%	$P < .001$	80%	13%	$P < .001$
Subcostal, iliohypogastric, ilioinguinal, genitofemoral, and lateral femoral cutaneous nerves.	186	259	79%	12%	$P < .001$	66%	20%	$P < .001$
Femoral nerve and its distal branches and the saphenous nerve in relation to anteromedial intermuscular septum.	347	482	91%	6%	$P < .001$	79%	15%	$P < .001$

were then provided with the 4-point proposal. Most agreed to the conditional "use" of the images, with 25% after a formal and educational disclosure, 10% following a bioethicists consensus, 15% after a *Bet Din* consensus validating *Piku'ach nefesh*,²⁷ 15% in conjunction with an official memorial, and 30% if all conditions were met; 10% of respondents would use Pernkopf's atlas regardless of those conditions; 25% of respondents would not use Pernkopf's atlas irrespective of those conditions.

Use of Anatomical Resources Atlases in Nerve Surgery

All respondents were asked about the type of anatomical resources they used (Table 3). Eighty-one percent (81%) reported the use of anatomical atlases, 86% specialized surgical textbooks, 65% original research/clinical journal articles, 29% societal educational resources, and 76% Internet resources. Of the anatomical atlases,^{2,17-24} 81% reported using Netter's atlas, 50% Gray's atlas, 33% Grant's atlas, 24% Sobotta's atlas, 14% Thieme's atlas, 13% Pernkopf's atlas, 12% Rohen's atlas, 7% Lippincott Williams and Wilkins' atlas, and 1% Morris' atlas (Table 4).

Netter's vs Pernkopf's Anatomical Plate Comparisons

Respondents who were "comfortable" with the use of Pernkopf's atlas following the 4-point proposal were given 6 sets of comparisons between similar Netter's and Pernkopf's plates (Table 5). The 6 comparisons were prefaced with an emphasis of anatomical nerve structures listed in Table 5. The respondents found Pernkopf's atlas having both greater anatomical detail (range 79%-91%) and greater utility for surgery (range 66%- 82%) when compared with Netter's ($P < .001$) in all plate comparisons.

Discussion

No systematic study exists that documents the use of Pernkopf's atlas in surgery either in the past or present. Even though the former publisher Urban & Schwarzenberg stopped publication of the work in 1994, there is anecdotal evidence that the atlas is still being used. The historical connection between the book and the Nazi regime presents ethical challenges in its use for intraoperative surgical planning.^{13,14} This study presents an assessment of the use of the atlas by nerve surgeons as well as an evaluation of the potential ethical implications involved.

The response rate (25%) was average with respect to surgical societies and includes a risk of nonresponse bias as a limitation of the study.³¹⁻³³ However, the results allow for qualitative conclusions. First and foremost, among them is the fact that a majority of nerve surgeons (59%) are aware of the atlas and 13% of the total population currently using it for surgery. Of surgeons that are aware of the atlas, 77% know about its historical Nazi origin. After presentation of the historical background of the atlas, most surgeons (69%) were "comfortable" with the use of Pernkopf's atlas in surgery, and a minority (15%) were "uncomfortable."

When surgeons were presented with 4 different ethical conditions that could be met in connection to the use of the atlas, a majority of those previously

"undecided" or "uncomfortable" about its use changed their position and were now willing to employ the images in surgery (Figure). While 65% of surgeons would use Pernkopf's atlas with the implementation of an ethical proposal, there were 29% who would use the atlas irrespective of these ethical conditions. The latter finding may derive from the unawareness of the still existing ethical controversy in using Pernkopf's atlas in surgery,¹⁴ as a significant percentage of surgeons (6%) would not use the Pernkopf atlas under any condition. This percentage is even higher among surgeons of Jewish descent (25%). Any evaluation of using Nazi medical data, including the paintings of executed prisoners in Pernkopf's atlas, needs to take account of the perspective of the victims, foremost amongst them Jews as the main target of Nazi persecution.^{29,30}

Therefore, the survey data from nerve surgeons of Jewish descent were specifically examined. Twenty of the 182 surgeons identified as of Jewish descent, and only 1 of them were currently using the Pernkopf atlas for surgical planning. After the presentation of the historical background of the atlas, there was substantial division of opinion in surgeons of Jewish descent, with 8 (40%) being comfortable and 9 (45%) uncomfortable with respect to using Pernkopf's atlas in surgery. However, after presentation of the 4-point proposal of ethical conditions, surgeons of Jewish descent changed their opinion with 15 (75%) being comfortable and 5 (25%) remaining uncomfortable in using Pernkopf's atlas in surgery. Importantly, 73% of surgeons of Jewish descent would like to see the implementation of the proposal compared to the 65% of all respondents. As the 4-point proposal can provide a roadmap towards the appropriate handling of Pernkopf's atlas, the second condition for achieving a consensus from bioethicists can only occur in part by proxy. Discussions within bioethics are continuously evolving and it is the individual's moral responsibility to recognize the outcomes of said discussions before employing the use of the atlas in surgery.¹⁴

There may exist a shift of opinion for using Pernkopf's atlas with the introduction of a new generation of surgeons into the workforce. Remarkably, 82% of surgical trainees would use the atlas in surgery and further adoption (100%) with the implementation of the 4-point proposal. This result aligns with most trainees finding value for using an advanced anatomical resource for learning surgery³⁴ and highlights the importance for discussing ethics in education when the Pernkopf atlas is used. This aligns with another study's finding that medical students would like to discuss Pernkopf's atlas within a bioethics course.²⁵

Currently, Pernkopf's atlas remains one of many choices among atlases and other anatomical resources used by nerve surgeons (Tables 3 and 4). In a comparison of selected images from Netter's atlas, the most often named atlas of use in this study (Table 4), nerve surgeons see greater anatomical detail and surgical utility in Pernkopf's images

(Table 5). An individual surgeon commented: "Netter's simplicity provides a great basis for surgery, however until seeing the complexity of peripheral nerves in Pernkopf's, I now understand the reason for its potential use," thus indicating the usefulness of Pernkopf's atlas in actual surgery, and Netter's atlas as a tool for anatomical orientation. This comment aligns with medical students identifying Netter's as a superior tool for learning compared to Pernkopf's.²⁵ As this study design prioritized the development of a 4-point proposal, the image comparison was performed at the end of the survey. Therefore, motivated cognition may play a role in these results for those that are historically aware of Pernkopf's atlas. Further comparison studies with other anatomical resources and atlases will explore the value of Pernkopf's atlas in anatomy and surgery.

The results of these studies come at a time of renewed interest for transparency in tissue ethics. At a 2017 conference on the "Medical ethics in the 70 years since the Nuremberg Code" in Vienna, the question of whether to "use or not to use" data gained from coercive Nazi medical research to benefit the lives of patients was discussed.²⁶ Recommendations were made at a symposium by *Yad Vashem*, the Holocaust Martyrs Authority in Jerusalem, on "*How to Deal with Holocaust Era Human Remains*" and include the "*Vienna Protocol*" for when Jewish or possibly Jewish remains are discovered.²⁷ In conjunction, we proposed 4 conditional points for the appropriate handling and continued use of Pernkopf's atlas in surgery and surgical education. This proposal was developed in response to *Yad Vashem's* request for a commemoration for the potential victims of Nazi terror and an acknowledgement documenting the history of Pernkopf in the atlas.²⁸

Conclusion

Nerve surgeons continue to use Pernkopf's atlas to inform surgical planning. The 4-point ethical proposal outlined here can be used as guidance for its ethical handling, including a provision to

memorialize the victims of the horrendous atrocities committed by the Nazi regime. The Pernkopf controversy continues to divide opinions in the world of surgery and elsewhere, which highlights the importance to communicate the atlas's historical origin and the associated ethical challenges for use in surgery.

Disclosures

Andrew Yee and Susan E. Mackinnon are cofounders of PASSIO Education. The other authors have no personal, financial, or institutional interest in any of the drugs, materials, or devices described in this article.

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