MAR Pathology & Clinical Research (2023) 2:5

Editorial Article

ChatGPT as a Virtual Assistant for creating IHC panels for a Pathologist

Siddharth Singla, MBBS*

***Correspondence to:** **Siddharth Singla, MBBS**, Dr. D. Y. Patil Medical College and Hospital and Research Centre, Sant Tukaram Nagar, Pimpri, Pune - 411 018, Maharashtra, India.

Copyright

Received: 01 September 2023

Published: 30 September 2023

Ever since its release in November 2022 ChatGPT took the world by storm. With all the immense possibilities now open with its use it led to multiple debates and conversations on how it would impact the healthcare and medical industry. I feel Pathology is one of the specialities that can best adapt to the new innovations in technology like these and utilize it to its fullest.

What exactly is ChatGPT?

In brief terms it is a generative AI that uses machine learning algorithms trained via Reinforcement Learning from Human Feedback (RLHF) model to generate competent , comprehensible and viable responses for a prompt [1]The field of pathology has always been closely linked to pattern recognition and using a large knowledge database , so it was inevitable that pathologists were one of the first people who were thought to be threatened by the large openly available artificial intelligence models. But disregarding these doomsayers , the ability of ChatGPT to act as a virtual assistant for a pathologist can be immensely valuable saving a lot of time and effort leading to more efficient work .This can be incredibly useful in selecting an Immunohistochemistry panel to differentiate between different lesions.

Immunohistochemistry (IHC) has become a standard method of diagnosis for surgical pathology. Because of the plethora of diagnoses and often subtle nature of diagnostic criteria, IHC finds particular utility in soft tissue tumors. The use of progressively small amounts of tissue for diagnosis highlights the importance of this method. The sensitivity and crispness of IHC stains have progressively improved with the advent of new techniques. [2] With the large diversity and availability of IHC stains sometimes it can be a hassle to select the best combination to build a panel for use. With scarce availability of online resources to help in this, ChatGPT can be a great way to help compile a comprehensible list in a short time with minimal effort.

In the Table below we can see a conversation asking ChatGPT to help differentiate a stomach GIST tumor and a smooth muscle tumor which can seem morphologically similar and require special IHC stains to differentiate. [3][4]

(Table 1)

As we can see it provides us with a list of some of the most common markers that any pathologist would use to build his IHC panel and we can also ask it to show results in a form that can be easy to read and understand. Of Course we should not take these results at face value as it still needs to be corroborated with the knowledge and expertise of the pathologist themselves. It does away the need for conducting long searches throughout the internet and books to look for the specific markers.

This also comes with its fair share of problems, because of limited databases some of the newer advances in the subject are not incorporated in results also as it does not cite any references about this information which can concern some people regarding its viability.

The creation for IHC panels also depends on the availability of them within the institution so it also doesn't take that in consideration which can also be an obstacle in its utilization in a pathologists office.

In conclusion I would like to say that incorporation of AI like ChatGPT within a pathologists office may not be a one stop solution and it certainly isn't something that could replace what we actually do. What it can be is a supporting tool to help decrease the work burden and make things more efficient. There are multiple other things we could utilize ChatGPT in , like forming a template for common lesions or to bounce off certain difficult differentials or just as an aid to help us keep our work system in order.

We should embrace this change in technology with open arms rather than with apprehension and negativity. Addition of such a tool in the daily workings when implemented with proper guidelines and while knowing its limitations would help transform the daily workings of the people in this field for the better. It is a well known fact that things that don't adapt to changes end up being forgotten and left out . We as clinicians and citizens of the modern world need to adapt to these changes and find different ways to make them work for us and for the betterment of the patients that we treat.

Table 1 :

Conversation with ChatGPT on differentiating between GIST and Smooth muscle Tumors	
Question	Response by ChatGPT
what's the difference between GIST and smooth muscle tumors of stomach	The main differences between Gastrointestinal Stromal Tumors (GISTs) and smooth muscle tumors of the stomach lie in their cellular origin, histological characteristics, and behavior: Cellular origin: • GISTs arise from the interstitial cells of Cajal (ICC) or their precursors. ICC are specialized cells in the gastrointestinal tract responsible for regulating gut motility. • Smooth muscle tumors of the stomach, specifically leiomyomas and leiomyosarcomas, originate from the smooth muscle cells present in the stomach wall. Histological characteristics: • GISTs have specific histological features, such as spindle cells or epithelioid cells, and are typically positive for immunohistochemical markers like CD117 (C-kit) and DOG1. Some GISTs can also be positive for CD34. • Smooth muscle tumors, especially leiomyomas, exhibit typical spindle-shaped smooth muscle cells and usually show strong positivity for smooth muscle markers like Smooth Muscle Actin (SMA) and desmin. Genetic and molecular features: • The majority of GISTs are driven by activating mutations in the KIT or PDGFRA genes, leading to uncontrolled cell growth.

	Molecular testing for these mutations can aid in diagnosing GISTs and guiding treatment decisions. • Smooth muscle tumors, on the other hand, do not typically harbor KIT or PDGFRA mutations.
Can you suggest some different stains to differentiate between GIST and smooth muscle tumor	To differentiate between gastrointestinal stromal tumors (GIST) and smooth muscle tumors, various immunohistochemical stains can be utilized. Here are some commonly used stains and markers that can aid in distinguishing between these two types of tumors: 1. **CD117** (C-kit): GISTs often show strong positivity for CD117, which is the hallmark of these tumors. Smooth muscle tumors, on the other hand, are usually negative for CD117. 2. **DOG1** (Discovered on GIST-1): DOG1 is another sensitive marker for GISTs and is positive in the majority of cases. Smooth muscle tumors are typically negative for DOG1. 3. **Smooth Muscle Actin (SMA**): Smooth muscle tumors, including leiomyomas and leiomyosarcomas, usually exhibit strong positivity for SMA. In contrast, GISTs are generally negative or only focally positive for SMA. 4. **Desmin**: Desmin staining is commonly positive in smooth muscle tumors, indicating their myogenic differentiation. GISTs are typically negative for desmin. 5. **S100 protein**: While GISTs are usually negative for S100 protein, some smooth muscle tumors, particularly leiomyosarcomas, may show focal S100 positivity. However, S100 staining alone is not sufficient to differentiate between these tumors. 6. **CD34**: CD34 is often positive in GISTs, particularly in gastric

GISTs. Smooth muscle tumors, including leiomyomas and leiomyosarcomas, are typically negative for CD34.

7. **Caldesmon**: Smooth muscle tumors usually exhibit diffuse positivity for caldesmon, whereas GISTs are typically negative.

Can you present the result in a table ?

Certainly! Here's a table summarizing the immunohistochemical staining patterns commonly observed in Gastrointestinal Stromal Tumors (GISTs) and smooth muscle tumors:

Stain/Marker	GIST	Smooth Muscle Tumors
CD117 (C-kit)	Strong positivity	Negative
DOG1	Positive	Negative
Smooth Muscle Actin (SMA)	Negative or focal positivity	Strong positivity
Desmin	Negative	Positive
S100 protein	Negative	Focal positivity in some cases (leiomyosarcoma)
CD34	Positive (particularly in gastric GISTs)	Negative

	<table><tr><td>Caldesmon</td><td>Negative</td><td>Diffuse positivity</td></tr></table>
Among the stains, which combination would be the most affordable ?	The affordability of a panel depends on various factors, including the availability and cost of individual stains or markers, as well as the specific laboratory or testing facility being utilized. However, based on commonly available stains and markers, the most affordable panel for differentiating between Gastrointestinal Stromal Tumors (GISTs) and smooth muscle tumors could include the following markers: 1. **CD117 (C-kit)**: This is a crucial marker for GISTs and is often available at a reasonable cost. 2. **Smooth Muscle Actin (SMA):** SMA staining can help differentiate smooth muscle tumors from GISTs and is commonly performed in pathology laboratories. Including these two markers in the panel would provide a cost-effective approach to distinguish between GISTs and smooth muscle tumors. Other markers mentioned in the previous responses, such as DOG1, Desmin, S100 protein, CD34, and Caldesmon, can provide additional diagnostic information but may increase the overall cost of the panel.

The author has no financial disclosures to declare and no conflicts of interest to report

Acknowledgement: “The authors acknowledge the guidance of The Good Research Project towards successful completion of this research and manuscript writing”.

References

1. https://openai.com/about/.
2. Parham DM. Immunohistochemical Markers of Soft Tissue Tumors: Pathologic Diagnosis, Genetic Contributions, and Therapeutic Options. Anal Chem Insights. 2015 Oct 29;10(Suppl 1):1-10. doi: 10.4137/ACI.S32730. PMID: 26549970; PMCID: PMC4627416.
3. Nishida T, Blay JY, Hirota S, Kitagawa Y, Kang YK. The standard diagnosis, treatment, and follow-up of gastrointestinal stromal tumors based on guidelines. Gastric Cancer. 2016 Jan;19(1):3-14. doi: 10.1007/s10120-015-0526-8. Epub 2015 Aug 15. PMID: 26276366; PMCID: PMC4688306.
4. Alyssa M. Krasinskas, Jeffrey D. Goldsmith,Chapter 14 - Immunohistology of the Gastrointestinal Tract, Editor(s): David J. Dabbs,Diagnostic Immunohistochemistry (Third Edition),W.B. Saunders,2011,Pages 500-540,ISBN 9781416057666,