

PULSE EXPERIENTIAL TEAM ASSIGNMENT

Team #: 29
1. Title of your PULSE experiential assignment. <i>Provide a creative and informative title.</i>
PathBud: Exploring the Pathology of Budd-Chiari Syndrome
2. Please summarize your PULSE experiential assignment (max 300 words). <i>Provide a non-technical (lay) summary of your PULSE assignment. Prompts to think about: What is the topic? What is the format? Why did you choose this topic and format? The summary for lay audience is a brief and accessible summary of the assignment that is used to explain complex ideas, technical writing and scientific terms to people who do not have prior knowledge of the subject (e.g., high school science level). This summary should include the importance, impact, and content of your assignment to a broader audience.</i> <i>[Team 23 is an example of an informative lay summary.]</i>
Our PULSE assignment focuses on Budd-Chiari syndrome, a rare but serious liver condition in which blood cannot properly flow out of the liver due to blocked veins. This disruption causes pressure to build up, reduces oxygen supply, and can lead to liver damage, swelling, and life-threatening complications if not recognized early. To present this topic, we created an interactive website learning module designed to make complex medical concepts clear and engaging for a general audience. The website is organized into key sections, including liver anatomy, causes of the condition, how the disease develops, signs and symptoms, complications, and treatment options. It also incorporates videos, visuals, and quizzes to support different learning styles and reinforce understanding. We chose this topic because it clearly demonstrates how a disruption in blood flow (a key concept in pathology) can affect organ function and overall health. Budd-Chiari syndrome is also relatively unknown, so increasing awareness can help promote earlier recognition and better outcomes for patients. We selected a website format because it allows information to be presented in a structured, visual, and interactive way, making it easier to understand compared to traditional text-heavy formats. Users can move through the material at their own pace and see how different concepts connect. Overall, this project aims to make complex medical information more accessible, raise awareness about liver disease, and highlight the importance of early diagnosis and treatment.
3. Provide up to 6 keywords relevant to your PULSE experiential assignment. <i>3-6 keywords are ideal.</i>
Budd-Chiari Syndrome, Hepatic Venous Outflow Obstruction, Liver Disease, Portal Hypertension, Pathophysiology, Thrombosis

4. Identify the course topic with which your PULSE assignment most aligns. Refer to the various topics outlined under 'Course content and Schedule' in the syllabus (e.g. Inflammation).
Section A: Hemodynamic Disorders, Thromboembolism & Shock
5. What are the learning outcomes? There should be a minimum of 2 learning outcomes for your assignments. For further information on learning outcomes, the Centre for Teaching and Learning offers information: https://teaching.uwo.ca/curriculum/coursedesign/learning-outcomes.html
1. Explain the etiology and pathogenesis of Budd-Chiari syndrome, including how primary and secondary causes of hepatic venous obstruction lead to increased sinusoidal pressure, reduced perfusion, hepatocellular injury, and progression to portal hypertension, fibrosis, and chronic liver disease. 2. Explain the clinical presentation of Budd-Chiari syndrome, including the classic triad and the progression of symptoms from early-stage congestion to severe complications like ascites, jaundice, and liver failure. 3. Describe the stepwise management of Budd-Chiari syndrome and how treatments restore blood flow, reduce pressure, and prevent disease progression. 4. Explain the major complications of Budd-Chiari syndrome and how prolonged obstruction leads to fibrosis, cirrhosis, and multi-organ dysfunction.
6. Why did the team select the chosen topic and the medium? How will the topic and medium of choice help learners?
Our team selected Budd-Chiari syndrome because it is a rare but serious liver condition. Because it is not widely known, we chose this topic to raise awareness and help learners understand how disruptions in blood flow can impact overall organ function and health. By choosing this topic, we aimed to increase awareness and make a complex condition more understandable for learners without a strong medical background. We selected an interactive website learning module as our medium because it allows complex information to be presented in a clear, organized, and engaging way compared to a classic format (eg. slide shows). The use of visuals, videos, and quizzes supports different learning styles and helps reinforce key concepts. To add on, we have an index section for learners that need extra help on terminology. This format helps learners by breaking complex ideas into simpler parts, allowing them to learn at their own pace and better understand how the concepts connect.
7. Did the team use an artificial intelligence (AI) technology tool? If so, which AI technology tool(s) did the team use? What other technology tools did the team use? Is the technology tool novel? Is the team using this technology tool in a novel fashion? If the team did not use technology tool, why did the team decide against using the technology tool(s)? Please include details (e.g., for what purpose was the tool used for? Why was the tool the best tool to use for your assignment? Are there alternative tools that were considered?)

Yes, our team used several artificial intelligence (AI) and technology tools, including Google Gemini, ChatGPT, and HeyGen, along with Canva as a design tool.

Google Gemini was used for image generation to create clear and visually accurate diagrams for concepts such as liver anatomy and disease progression. ChatGPT was used to assist with drafting, simplifying, and organizing written content to ensure it was accurate and appropriate for a lay audience. HeyGen was used to create AI-generated videos with realistic human avatars, allowing us to present information in a more engaging and interactive format. Canva was used to design graphics, structure the layout, and improve the overall visual organization of the website.

While tools like ChatGPT and Gemini are widely used, we applied them in a purposeful and integrated way by combining AI-generated text, visuals, and video into a single interactive learning module. The use of HeyGen can be considered relatively novel, particularly in how we used AI-generated avatars to simulate teaching and enhance engagement within an educational setting.

We also considered using Sora and Synthesia for video generation. However, Sora was not selected due to cost limitations and restricted usage, and Synthesia only offered a short trial (approximately 3 minutes), which limited our ability to create multiple videos for the module.

These tools were chosen because they allowed us to present complex information in a clear, accessible, and engaging way. Compared to more traditional tools such as PowerPoint or basic video editors, our selected tools provided more dynamic and interactive outputs.

Overall, this combination of tools enhanced learner engagement, improved clarity, and allowed us to create a more effective and accessible educational resource.

8. How is your PULSE experiential assignment innovative and/or novel?

Describe what about the PULSE assignment is innovative/novel. Is there a particular component or content that is innovative/novel? How is it different from other content that already exists?

Our PULSE experiential assignment is innovative in both its format and delivery of content, combining multiple interactive and AI-driven elements to enhance learning. Rather than presenting information in a single, static format, our project integrates text, visuals, quizzes, and AI-generated videos into one cohesive learning experience. This multimodal approach supports different learning styles and encourages active engagement, making complex medical concepts more accessible to a broader audience.

A particularly novel component of our project is the use of AI-generated video presenters through HeyGen, which allows us to deliver content in a way that closely resembles real-life instruction. These realistic avatars, combined with visual aids, create a more immersive and engaging experience compared to traditional

educational materials. This adds a human-like element to digital learning that is not commonly seen in standard undergraduate assignments.

Our project is also innovative in how it presents Budd-Chiari syndrome through a structured, step-by-step learning pathway. By guiding users from foundational concepts, such as liver anatomy, to more advanced topics like pathogenesis and treatment, our module builds understanding progressively. Compared to existing resources, which are often either highly technical or overly simplified, our module strikes a balance by being accurate, interactive, and accessible. This combination of structured learning and interactive design makes our assignment a more engaging and modern approach to learning medical concepts.

9. If you used an AI tool, please copy and paste the prompt(s)/question(s) used along with the output(s)/answer(s) from the AI tool.

The response here is to allow others to replicate the team's work. If the prompts/outputs are lengthy (over 1 page), please attach it as a separate document and note below [Please see attached document].

Please see attached document:

AI_Prompts_Team#29

10. If you did not use an AI tool, please attach a copy of the team's notes to the assignment.

The response here is to allow others to observe the 'behind the scenes' team's work.

Please see attached document:

PULSE_Outline_Team#29

11. How did the team ensure the veracity of the information presented in the PULSE assignment?

The response should highlight how the team has ensured that the information presented in the assignment is evidence-based and not spreading misinformation. You should specifically mention which databases (if any) or textbook materials you used, and how you kept track of the sources/references for each claim. If AI provided you with false information, please describe how the team has fact-checked the AI response and the legitimate (scientific) sources you used. A reference document should be provided in the reference section (15. References) below. Please ensure to include in-text citations in your assignment where applicable.

Our team ensured the veracity of the information presented in our PULSE assignment by relying on evidence-based, peer-reviewed scientific sources and systematically validating all content. We primarily used reputable databases such as PubMed, NCBI, and ScienceDirect accessed through Western Library, along with trusted clinical resources like the Cleveland Clinic. These sources provided accurate and up-to-date information on the etiology, pathogenesis, signs and symptoms, and treatment of Budd-Chiari syndrome.

To ensure accuracy, we cross-referenced multiple sources for each key concept rather than relying on a single article. All claims included in the module were supported by scientific literature, and we incorporated in-text citations throughout both written content and visuals to clearly indicate the source of each piece of information. Image references were also properly cited to ensure transparency. We maintained a

structured reference list to track all sources used, which is included in the reference section of our assignment.

We used AI tools such as ChatGPT to assist with drafting and organizing content; however, AI was not used as a primary source of information. All AI-generated content was critically evaluated and verified against peer-reviewed journal articles and clinical sources before inclusion. If discrepancies arose, we prioritized information from established scientific literature.

Additionally, our team reviewed each other's work to ensure consistency, clarity, and accuracy across all sections. This combination of credible databases, cross-referencing, proper citation of text and images, and careful verification of AI-assisted content ensured that our assignment is accurate, reliable, and evidence-based.

12. Write a meaningful team reflection about the PULSE session (max 250 words).

Prompts to help your team write the reflection: Were there any team/individual biases that surfaced when creating content for the assignment? Did the team implement any practices to ensure the content was equitable, diverse, and/or inclusive? How has the PULSE assignment helped with the team's learning? If the team had to estimate, how long did the assignment take? What worked well for your team? What would the team do differently next time? What were the opportunities and challenges with creating the PULSE assignment to help others' learning? Were there any barriers or limitations?

As a team, this PULSE assignment was a valuable learning experience that challenged us to translate complex medical information into a format that is both accurate and accessible.

One bias that surfaced was assuming a certain level of prior medical knowledge, which initially made our explanations too technical. To address this, we simplified language, defined key terms using an index, and used visuals/videos and multiple formats of delivery to ensure the content was accessible to learners from diverse backgrounds and supported different learning styles.

In terms of our team learning, this assignment strengthened our understanding of Budd-Chiari syndrome and improved our ability to communicate complex scientific concepts clearly to a non-expert audience. The use of interactive elements and AI tools helped us think more critically about how people learn, rather than just what they learn.

Overall, the project took approximately 15–20 hours to complete, including research, content creation, fact-checking, and website development. What worked well for our team was strong collaboration and clear division of responsibilities, which allowed us to stay organized and efficient.

One challenge we faced was balancing depth of content with accessibility, as well as ensuring consistency across different sections. If we were to do this again, we would spend more time planning the structure early on to improve flow and cohesion.

Despite these challenges, this project provided a meaningful opportunity to create a resource that supports others' learning in an engaging and innovative way.

13. Write the contributions of individual team members using unique initials.

Example: All team members contributed to the design of the prompts used in the technology tool, ChatGPT (GPT-3.5). T.K and T.K2 fact checked the information presented by ChatGPT using published literature on PubMed (PMID 29211319, 32477271). Y.Z finalized and formatted the final infographic and compiled the prompts and outputs. P.E was involved in...

All team members contributed to the design of prompts used in ChatGPT, Gemini, and HeyGen for content development and organization.

C.C. and V.Y. were responsible for fact-checking all information using primary and peer-reviewed scientific literature to ensure accuracy and reliability.

C.C. and V.Y. collaboratively developed the home page of the learning module.

V.Y. was primarily responsible for the overview and signs and symptoms sections, while C.C. focused on the treatment and complications sections.

C.C and V.Y both contributed to the index section as well as references.

Both team members also contributed to the formatting, integration of content, and overall compilation of the final website, ensuring consistency, clarity, and a cohesive learning experience.

15. References

Please provide a numbered reference list with Nature citation style. [Please feel free to use citation management software (i.e., free citation manager, e.g., Zotero and Mendeley)]

1. Aydinli M, Bayraktar Y. Budd-Chiari syndrome: Etiology, pathogenesis and diagnosis. *World Journal of Gastroenterology*. 2007;13(19):2693-2696. doi:10.3748/wjg.v13.i19.2693
2. Hitawala AA, Goosenberg E. Budd Chiari Syndrome [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2026. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK558941/>
3. Ferral H, Behrens G, Lopera J. Budd-Chiari syndrome. *AJR American journal of roentgenology* [Internet]. 2012 Oct 1;199(4):737–45. doi:10.2214/AJR.12.9098
4. DeLeve LD, Valla DC, Garcia-Tsao G. Vascular disorders of the liver. *Hepatology* [Internet]. 2009 May 1;49(5):1729–64. doi:10.1002/hep.22772
5. Bansal V, Gupta P, Sinha S, Dhaka N, Kalra N, Vijayvergiya R, et al. Budd-Chiari syndrome: imaging review. *The British Journal of Radiology*. 2018 Dec;91(1092):20180441. doi:10.1259/bjr.20180441
6. DeVries JJ, Myers HA, Buffington J, Brant A. Chronic abdominal pain: Budd-Chiari syndrome with converging pathologies. *Journal of vascular nursing*. 2025;43(4):246–249. doi:10.1016/j.jvn.2025.08.007
7. Budd-Chiari syndrome: Causes, Symptoms, Treatment & Outlook [Internet]. Cleveland Clinic. Available from: <https://my.clevelandclinic.org/health/diseases/21097-budd-chiari-syndrome>
8. European Association for the Study of the Liver. EASL Clinical Practice Guidelines: Vascular diseases of the liver. *Journal of Hepatology*. 2016;64(1):179–202. doi:10.1016/j.jhep.2015.07.040
9. Plessier A, Valla DC. Budd-Chiari Syndrome. *Seminars in Liver Disease*. 2008 Aug;28(03):259–69. doi:10.1055/s-0028-1085094
10. Momodu II, Bartholomew JR. Anticoagulation [Internet] PubMed. Treasure Island (FL): StatPearls Publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK560651/>
11. Budd-Chiari syndrome medication. Medscape. Updated 2025 Jul 21. Available from: <https://emedicine.medscape.com/article/184430-medication>
12. Crossan K, Jones MW. Portacaval shunt [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK563212/>
13. Mancuso A. Budd–Chiari syndrome management: Controversies and open issues. *Diagnostics (Basel)*. 2022;12(11):2670. doi:10.3390/diagnostics12112670.

14. Wells RG. Cellular Sources of Extracellular Matrix in Hepatic Fibrosis. *Clinics in Liver Disease*. 2008 Nov;12(4):759–68. doi:10.1016/j.cld.2008.07.008
15. Valla DC. Primary Budd–Chiari syndrome. *J Hepatol*. 2009;50(1):195–203. doi:10.1016/j.jhep.2008.10.007
16. Bataller R, Brenner DA. Liver fibrosis. *J Clin Invest*. 2005;115(2):209–218. doi:10.1172/JCI24282
17. Ranasinghe IR, Sharma B, Bashir K. Hepatorenal syndrome [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2023 Aug 8. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK430856/>
18. Mandiga P, Kommu S, Bollu PC. Hepatic encephalopathy [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2025 Jan 20. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK430869/>

16. Annotated Bibliography

An annotated bibliography is a list of sources (books, articles, websites, etc.) that you used for your project. Each entry has two parts:

- 1. Citation – written in the required citation style (same formatting and order as the Nature citation style in your list of references).*
- 2. Annotation – a short paragraph that summarizes, evaluates, and explains how the source is useful for your assignment.*

Why do this?

- Helps you keep track of your research.*
- Shows your instructor you read and understood your sources.*
- Develops critical thinking by requiring you to evaluate the quality and relevance of each source.*

Write the annotation (about 150–200 words each)

- Summary: Briefly describe the main argument or purpose of the source.*
- Evaluation: Comment on the credibility, strengths, or weaknesses of the source.*
- Relevance: Explain how you will use this source in your assignment.*

1. Aydinli M, Bayraktar Y. Budd-Chiari syndrome: Etiology, pathogenesis and diagnosis. *World Journal of Gastroenterology*. 2007;13(19):2693-2696. doi:10.3748/wjg.v13.i19.2693

Aydinli and Bayraktar provide a clear overview of Budd-Chiari syndrome, focusing on its causes, pathogenesis, and diagnosis. The article explains that the condition results from obstruction of hepatic venous outflow, most commonly due to hypercoagulable states such as myeloproliferative disorders. It also describes how this obstruction increases sinusoidal pressure, leading to hepatic congestion, reduced perfusion, and progression to portal hypertension and liver damage. Diagnostic approaches, particularly imaging techniques, are also briefly discussed. This source is credible as it is a peer-reviewed article published in the *World Journal of Gastroenterology*. Its strength lies in its clear and structured explanation of key concepts. However, as it is somewhat older, it may not include the most recent advances in management. This source will be used to support the overview section of my assignment, particularly in explaining the etiology and pathogenesis of Budd-Chiari syndrome.

2. Hitawala AA, Goosenberg E. Budd Chiari Syndrome [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2026. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK558941/>

Hitawala and Goosenberg's StatPearls article on Budd-Chiari syndrome provides a comprehensive and up-to-date overview of the condition, including its definition, classification, causes, and clinical features. It defines the syndrome as hepatic

venous outflow obstruction not caused by cardiac disease and distinguishes between primary forms, caused by thrombosis within the veins, and secondary forms, resulting from external compression such as tumors. The source also highlights the rarity of the condition and explains its progression from venous obstruction to liver damage and potential complications. This source is highly credible as it is published in the NCBI Bookshelf and written for medical education purposes. Its strength lies in its clear, structured, and clinically relevant explanations. Additionally, it is regularly updated, making it more current than older journal articles. However, it is more generalized and may lack in-depth discussion of specific research findings. This source will be used to support the overview and signs and symptoms section of my assignment, particularly explaining primary and secondary Budd-Chiari syndrome as well as the signs and symptoms.

3. Ferral H, Behrens G, Lopera J. Budd-Chiari syndrome. *AJR American journal of roentgenology* [Internet]. 2012 Oct 1;199(4):737–45. doi:10.2214/AJR.12.9098

Ferral, Behrens, and Lopera's article examines Budd-Chiari syndrome from a radiologic perspective, with a strong focus on imaging findings and interventional management. The article explains how Budd-Chiari syndrome involves obstruction of hepatic venous outflow and describes the role of imaging techniques in identifying venous blockage, liver changes, and complications of the disease. It also emphasizes the importance of radiology not only in diagnosis but also in guiding treatment approaches such as endovascular intervention. This source is credible because it was published in the *American Journal of Roentgenology*, a peer-reviewed medical journal, and written by specialists in the field. A major strength of the article is its detailed focus on imaging, which is especially useful for understanding how Budd-Chiari syndrome is recognized clinically. However, because its emphasis is radiologic, it is less useful for broader background on etiology alone. This source will be used to support the chronic symptoms section of my assignment, particularly in explaining the long-term clinical manifestations of Budd-Chiari syndrome, as well as the discussion of secondary Budd-Chiari syndrome and its underlying causes.

4. DeLeve LD, Valla DC, Garcia-Tsao G. Vascular disorders of the liver. *Hepatology* [Internet]. 2009 May 1;49(5):1729–64. doi:10.1002/hep.22772

DeLeve, Valla, and Garcia-Tsao's article reviews major vascular disorders of the liver, including Budd-Chiari syndrome, and explains their causes, clinical features, and diagnostic approach. For Budd-Chiari syndrome, the article distinguishes between primary disease caused by venous thrombosis and secondary disease caused by external compression or invasion of the hepatic veins or inferior vena cava. Because it is a broader review, it is especially useful for placing secondary Budd-Chiari syndrome within the larger context of hepatic

vascular disorders. This source is credible because it is a peer-reviewed review article available through PMC and written by recognized experts in hepatology. A major strength is its broad and clinically grounded discussion of vascular liver disease. However, because it covers several disorders rather than only Budd-Chiari syndrome, it is less detailed on some specific aspects of the condition. This source will be used to support the section on secondary Budd-Chiari syndrome, particularly in explaining how external lesions such as tumors can compress or invade hepatic venous outflow and lead to obstruction.

5. Bansal V, Gupta P, Sinha S, Dhaka N, Kalra N, Vijayvergiya R, et al. Budd-Chiari syndrome: imaging review. *The British Journal of Radiology*. 2018 Dec;91(1092):20180441. doi:10.1259/bjr.20180441

Bansal, Gupta, Sinha, Dhaka, Kalra, Vijayvergiya, Dutta, and Kochhar's article reviews Budd-Chiari syndrome with a focus on imaging, but it also explains the underlying disease process. The authors describe Budd-Chiari syndrome as hepatic venous outflow obstruction that leads to increased sinusoidal pressure, hepatic congestion, reduced portal perfusion, and liver injury. The article also shows how these hemodynamic changes can progress to portal hypertension, ascites, and chronic structural changes in the liver. Although the paper is centered on radiologic findings, it still provides a strong explanation of how venous obstruction produces the major pathological consequences of the disease. This source is credible because it is a peer-reviewed article published in the *British Journal of Radiology*. One of its strengths is that it connects imaging findings to the underlying mechanisms of disease, making the pathogenesis easier to understand visually and clinically. However, because its main emphasis is imaging, it is less detailed than a source focused entirely on pathophysiology. This source will be used to support the pathogenesis section of my assignment, particularly in explaining how hepatic venous obstruction leads to congestion, liver injury, and portal hypertension.

6. DeVries JJ, Myers HA, Buffington J, Brant A. Chronic abdominal pain: Budd-Chiari syndrome with converging pathologies. *Journal of vascular nursing*. 2025;43(4):246–249. doi:10.1016/j.jvn.2025.08.007

DeVries, Myers, Buffington, and Brant's 2025 article discusses Budd-Chiari syndrome through a clinical case and highlights its presentation, progression, and underlying mechanisms. The article explains that Budd-Chiari syndrome involves hepatic venous outflow obstruction and shows how this can lead to hepatomegaly, ascites, fibrosis, cirrhosis, and even death if left untreated. It is especially useful for signs and symptoms because it connects the disease process to clinical findings, while also showing how venous obstruction contributes to liver damage over time. This source is credible because it is a recent peer-reviewed journal article published through ScienceDirect. A major

strength is that it presents Budd-Chiari syndrome in a clinically applied way, making the symptoms and disease progression easier to understand. However, because it focuses on a specific case, it may not provide as broad a discussion as a larger review article. This source will be used to support the signs and symptoms section of my assignment, and to provide additional support for the pathogenesis section.

7. Budd-Chiari syndrome: Causes, Symptoms, Treatment & Outlook [Internet]. Cleveland Clinic. Available from:
<https://my.clevelandclinic.org/health/diseases/21097-budd-chiari-syndrome>

The Cleveland Clinic webpage provides a patient-friendly overview of Budd-Chiari syndrome, focusing on its causes, symptoms, and general progression. It explains that the condition occurs when hepatic veins become blocked, leading to a buildup of blood in the liver. The source highlights key symptoms such as abdominal pain, ascites, jaundice, and liver enlargement, while also noting that symptom severity varies depending on the extent of venous obstruction. It also briefly connects these symptoms to underlying processes such as congestion and portal hypertension. This source is credible because it comes from a well-known academic medical institution that provides medically reviewed information. A major strength is its clarity and accessibility, making complex concepts easy to understand. However, it is less detailed than peer-reviewed journal articles and is intended for a general audience rather than in-depth scientific analysis. This source will be used to support the signs and symptoms section of my assignment, particularly in describing common clinical presentations of Budd-Chiari syndrome in a clear and accessible way.

8. European Association for the Study of the Liver. EASL Clinical Practice Guidelines: Vascular diseases of the liver. *Journal of Hepatology*. 2016;64(1):179–202. doi:10.1016/j.jhep.2015.07.040

This source provides comprehensive clinical guidelines for the diagnosis, pathophysiology, and management of vascular liver diseases, including Budd-Chiari syndrome. It explains that obstruction of hepatic venous outflow leads to increased sinusoidal pressure, hepatic congestion, and reduced blood flow, resulting in liver injury. Over time, this process can progress to fibrosis, cirrhosis, and complications such as portal hypertension and liver failure. The guidelines also emphasize a stepwise approach to management, focusing on restoring blood flow and preventing disease progression. Developed by the European Association for the Study of the Liver (EASL) and published in the *Journal of Hepatology*, this is a highly credible, peer-reviewed, and widely used clinical resource. Its major strength lies in providing an authoritative and evidence-based synthesis of current knowledge and clinical practice. However, as a guideline, it summarizes existing research rather than presenting original experimental data.

This source is highly relevant to the assignment, as it supports key concepts related to disease progression and complications in Budd–Chiari syndrome. Specifically, it provides strong evidence linking venous obstruction to hepatic congestion, fibrosis, cirrhosis, and portal hypertension, directly supporting the discussion of complications and management strategies.

9. Plessier A, Valla DC. Budd-Chiari Syndrome. *Seminars in Liver Disease*. 2008 Aug;28(03):259–69. doi:10.1055/s-0028-1085094

This source provides a comprehensive overview of the pathophysiology and management of Budd–Chiari syndrome, with a strong focus on both disease progression and the stepwise treatment approach used in clinical practice. It explains that hepatic venous outflow obstruction leads to congestion, increased sinusoidal pressure, and reduced oxygen delivery, resulting in chronic hepatocellular injury that drives the development of liver fibrosis. Over time, persistent damage progresses to cirrhosis, characterized by structural distortion and impaired liver function. The article also highlights that anticoagulation is the foundation of therapy, used to prevent further thrombus formation and disease progression, while outlining additional interventions such as angioplasty, TIPS, and liver transplantation for more advanced or refractory cases. It describes how angioplasty restores venous outflow, TIPS decompresses the liver and reduces portal hypertension, and transplantation serves as definitive treatment. Published in *Seminars in Liver Disease*, a reputable peer-reviewed journal, this source is highly credible and widely cited. Its strengths include clear integration of pathophysiology and treatment strategies; however, as a review article, it summarizes existing research rather than presenting new data. This source is specifically used to support the liver fibrosis section by explaining how chronic congestion leads to hepatocellular injury and ECM accumulation, as well as the treatment section by justifying the use of anticoagulation, angioplasty, TIPS, and liver transplantation in managing disease progression.

10. Momodu II, Bartholomew JR. Anticoagulation [Internet] PubMed. Treasure Island (FL): StatPearls Publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK560651/>

This source provides a comprehensive overview of anticoagulation therapy, including its mechanisms, classifications, and clinical applications. It explains that anticoagulants work by interfering with the coagulation cascade, preventing clot formation through inhibition of key factors such as thrombin and Factor Xa. The article also outlines commonly used medications, including heparin, warfarin, and direct oral anticoagulants (DOACs), and describes their mechanisms of action. As part of the National Center for Biotechnology Information StatPearls collection, this source is highly credible, peer-reviewed, and widely used in medical education and clinical practice. Its strengths include clear explanations of

drug mechanisms and well-organized descriptions of anticoagulant classes; however, as a general review, it is not specific to Budd–Chiari syndrome and does not provide disease-specific clinical data. This source is relevant to the assignment as it supports the inclusion of specific anticoagulant examples by explaining how drugs such as heparin, warfarin, and DOACs function, helping to justify their use and clarify their role in preventing clot formation in the treatment section.

11. Budd-Chiari syndrome medication. Medscape. Updated 2025 Jul 21. Available from: <https://emedicine.medscape.com/article/184430-medication>

This source provides an overview of the pharmacological management of Budd–Chiari syndrome, highlighting the role of medications such as diuretics and thrombolytic agents in treatment. It explains that diuretics are used to manage complications like ascites by reducing fluid accumulation associated with portal hypertension, while thrombolytic therapy is used in selected cases to dissolve existing blood clots and restore hepatic blood flow. Together, these therapies address both the symptoms and the underlying vascular obstruction of the disease. As a Medscape clinical resource, this source is credible and widely used in medical education and practice, offering up-to-date, clinically relevant information written by healthcare professionals. Its strengths include clear, concise explanations of treatment approaches and practical clinical application. However, as an online reference, it summarizes established knowledge rather than presenting original research and may lack detailed mechanistic depth. This source is highly relevant to the assignment as it supports the inclusion of both diuretics and thrombolytic therapy in the treatment section, helping to explain their distinct roles in managing fluid complications and restoring blood flow in Budd–Chiari syndrome.

12. Crossan K, Jones MW. Portacaval shunt [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK563212/>

This source provides a detailed overview of portacaval shunting as a surgical intervention used to manage portal hypertension and its complications. It explains that surgical shunts function by diverting blood from the portal venous system to the systemic circulation, thereby reducing portal pressure and controlling complications such as variceal bleeding and ascites. The article also outlines different types of shunts, including portocaval and mesocaval shunts, and discusses their mechanisms, indications, and associated risks, particularly hepatic encephalopathy due to bypass of liver detoxification. As part of the StatPearls collection published by the National Center for Biotechnology Information, this source is highly credible, peer-reviewed, and widely used in medical education and clinical practice. Its strengths include clear explanations of surgical techniques and clinical applications, as well as accessible, up-to-date

information. However, as a general clinical review, it is not specific to Budd–Chiari syndrome and does not provide disease-specific outcome data. This source is relevant to the assignment as it supports the surgical shunting section by explaining the mechanism, types, and clinical purpose of shunts, helping justify their role in reducing portal hypertension and managing complications when less invasive treatments are not effective.

13. Mancuso A. Budd–Chiari syndrome management: Controversies and open issues. *Diagnostics* (Basel). 2022;12(11):2670. doi:10.3390/diagnostics12112670.

This source provides a comprehensive review of the management of Budd–Chiari syndrome, with a focus on the controversies and decision-making strategies involved in treatment selection. It explains that management follows a stepwise approach, beginning with medical therapy and progressing to more invasive interventions such as angioplasty, TIPS, or liver transplantation depending on disease severity and patient response . The article highlights that treatment decisions are largely based on clinical presentation, including the presence of symptoms, liver function status, and progression of disease, with more aggressive interventions required in cases of worsening liver function or complications. As a peer-reviewed article published in *Diagnostics*, this source is highly credible and reflects current clinical perspectives on Budd–Chiari syndrome management. Its strengths include a clear explanation of treatment pathways and emphasis on individualized patient care; however, as a review article, it synthesizes existing literature rather than presenting new experimental data. This source is highly relevant to the assignment as it supports the treatment decision factors section by explaining how clinicians determine whether to use conservative or aggressive management based on disease severity, progression, and response to therapy.

14. Wells RG. Cellular Sources of Extracellular Matrix in Hepatic Fibrosis. *Clinics in Liver Disease*. 2008 Nov;12(4):759–68. doi:10.1016/j.cld.2008.07.008

This article explains the cellular mechanisms underlying liver fibrosis, with a focus on hepatic stellate cells as the primary drivers of extracellular matrix (ECM) production. It describes how liver injury, inflammation, and hypoxia activate stellate cells, leading to excessive deposition of ECM components such as collagen, which disrupts normal liver architecture and contributes to progressive scarring. The article further highlights how persistent injury promotes the transition from fibrosis to cirrhosis, characterized by structural distortion and impaired liver function. Published in *Hepatology*, a highly reputable and peer-reviewed journal, this source is scientifically rigorous and widely cited within liver research. Its strengths include detailed mechanistic explanations and strong experimental evidence; however, its highly technical nature may require

simplification for a broader audience. This source is highly relevant to the assignment as it supports the explanation of fibrosis in Budd–Chiari syndrome by providing a clear mechanistic understanding of how chronic hepatic injury leads to stellate cell activation and ECM accumulation, helping to explain the progression from fibrosis to cirrhosis in the disease.

15. Valla DC. Primary Budd–Chiari syndrome. *J Hepatol*. 2009;50(1):195–203. doi:10.1016/j.jhep.2008.10.007

This article provides a detailed overview of primary Budd–Chiari syndrome, focusing on its pathophysiology, clinical presentation, and progression. It explains that obstruction of hepatic venous outflow leads to increased sinusoidal pressure and hepatic congestion, which is transmitted backward into the portal venous system, resulting in portal hypertension. The article also describes how this elevated pressure promotes the formation of collateral circulation, portosystemic shunts, and varices, as well as complications such as ascites and splenomegaly. Published in the *Journal of Hepatology*, a highly reputable and peer-reviewed journal, this source is widely cited and considered authoritative in liver disease research. Its strengths include a clear explanation of disease mechanisms and strong integration of clinical and physiological concepts; however, as a review article, it summarizes existing research rather than presenting new experimental data. This source is highly relevant to the assignment as it supports the portal hypertension section by explaining how hepatic venous obstruction leads to increased pressure, collateral formation, and complications such as ascites and variceal bleeding in Budd–Chiari syndrome.

16. Bataller R, Brenner DA. Liver fibrosis. *J Clin Invest*. 2005;115(2):209–218. doi:10.1172/JCI24282

This article provides a detailed overview of the mechanisms underlying liver fibrosis and its progression to cirrhosis, with a focus on cellular processes such as hepatic stellate cell activation and extracellular matrix (ECM) deposition. It explains that chronic liver injury triggers a wound-healing response, leading to excessive accumulation of ECM proteins like collagen, which disrupts normal liver architecture. Over time, continued fibrosis results in the formation of fibrotic bands and regenerative nodules, marking the transition to cirrhosis and causing structural distortion and impaired liver function. Published in the *Journal of Clinical Investigation*, a highly reputable and peer-reviewed journal, this source is widely cited and recognized for its strong scientific rigor. Its strengths include a clear, mechanistic explanation of fibrosis progression and strong experimental support; however, its highly technical focus may require simplification for broader audiences. This source is highly relevant to the assignment as it supports the liver cirrhosis section by explaining how persistent fibrosis leads to architectural distortion, increased resistance to blood flow, and impaired hepatocyte function,

helping to justify the progression from fibrosis to cirrhosis and its associated complications.

17. Ranasinghe IR, Sharma B, Bashir K. Hepatorenal syndrome [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2023 Aug 8. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK430856/>

This source provides a comprehensive overview of hepatorenal syndrome, a severe complication of advanced liver disease characterized by functional kidney failure without structural damage. It explains that liver dysfunction leads to significant circulatory changes, particularly vasodilation in the splanchnic circulation, which reduces effective blood volume reaching vital organs. In response, the body activates compensatory systems such as the renin–angiotensin–aldosterone system, causing vasoconstriction of renal blood vessels and decreased kidney perfusion. Over time, this results in impaired filtration and progression to kidney failure. As part of the StatPearls collection published by the National Center for Biotechnology Information, this source is highly credible, peer-reviewed, and widely used in medical education and clinical practice. Its strengths include clear explanations of the underlying pathophysiology and strong clinical relevance; however, it is a general review and not specific to Budd–Chiari syndrome. This source is highly relevant to the assignment as it supports the hepatorenal syndrome section by explaining how liver dysfunction leads to decreased effective blood volume, renal vasoconstriction, and reduced kidney perfusion, directly aligning with the mechanism described and helping to justify the progression to kidney failure in advanced disease.

18. Mandiga P, Kommu S, Bollu PC. Hepatic encephalopathy [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2025 Jan 20. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK430869/>

This source provides a comprehensive overview of hepatic encephalopathy, a neuropsychiatric complication of advanced liver dysfunction characterized by altered mental status, confusion, and, in severe cases, coma. It explains that impaired liver function reduces the body's ability to detoxify substances such as ammonia, leading to their accumulation in the systemic circulation. Elevated ammonia levels disrupt normal brain function and contribute to neurological impairment, while portosystemic shunting further allows toxins to bypass the liver and worsen their buildup. As part of the StatPearls collection published by the National Center for Biotechnology Information, this source is highly credible, peer-reviewed, and widely used in medical education and clinical practice. Its strengths include clear explanations of clinical features and underlying mechanisms; however, it is a general review and not specific to Budd–Chiari syndrome. This source is highly relevant to the assignment as it supports the hepatic encephalopathy section by explaining how impaired detoxification and

ammonia accumulation lead to neurological dysfunction, directly aligning with the mechanism described and reinforcing its role as a complication of advanced liver disease.