



Diagnostic Exercise

From The Davis-Thompson Foundation*

Case #: **194**; Month: **August**; Year: **2022**

Answer sheet

Title: Porcine circovirus 2 hepatitis in 60-day-old commercial pigs

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Clinical history: Sixty-day-old commercial pigs with coughing, thumping, and 2% mortality in the herd. The total number of pigs in the herd was not reported.

Macroscopic findings: Fresh samples of lung, liver, spleen, tonsil, and lymph node from 2 pigs were received. Both lung samples were mildly non-collapsing with multifocal small hemorrhages and the ventral aspects were pale tan and consolidated. One sample of lung had moderate amounts of fibrinous exudate on the pleura. The liver samples had a mildly corrugated appearance.

Microscopic findings:

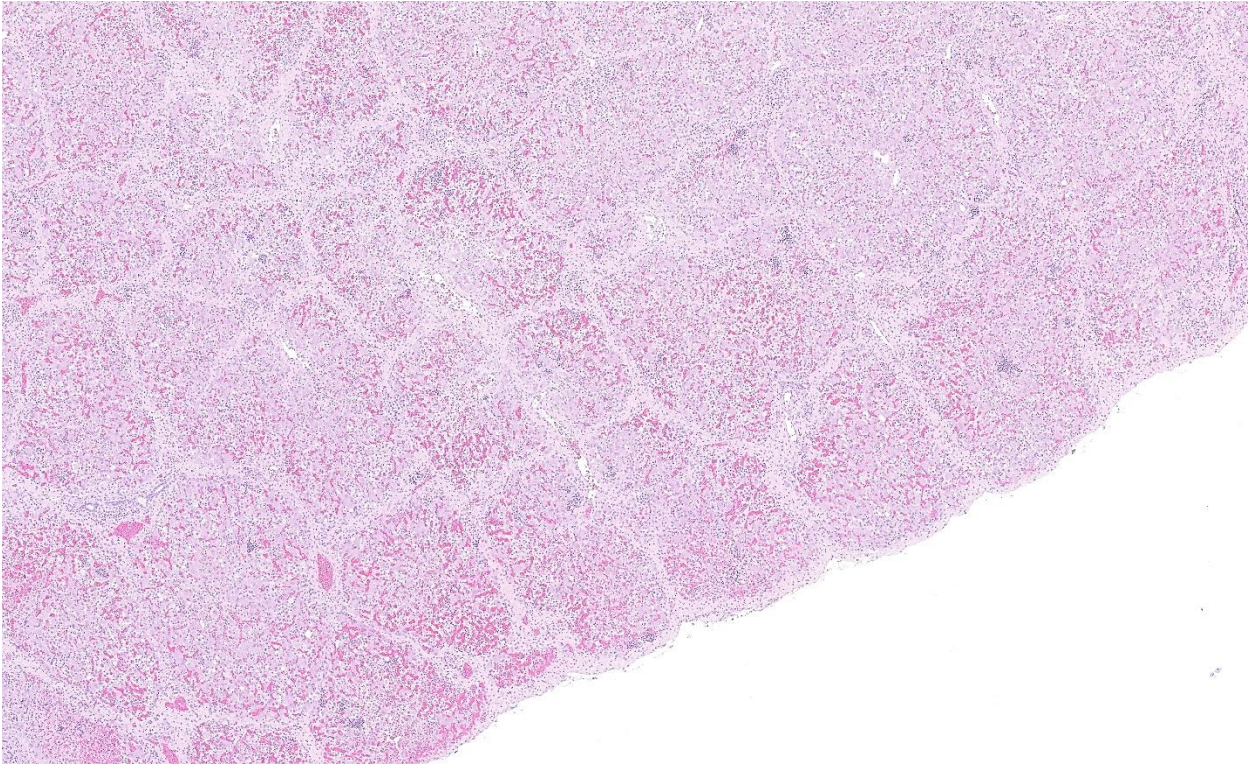


Figure 1: Liver. H&E, 40x.

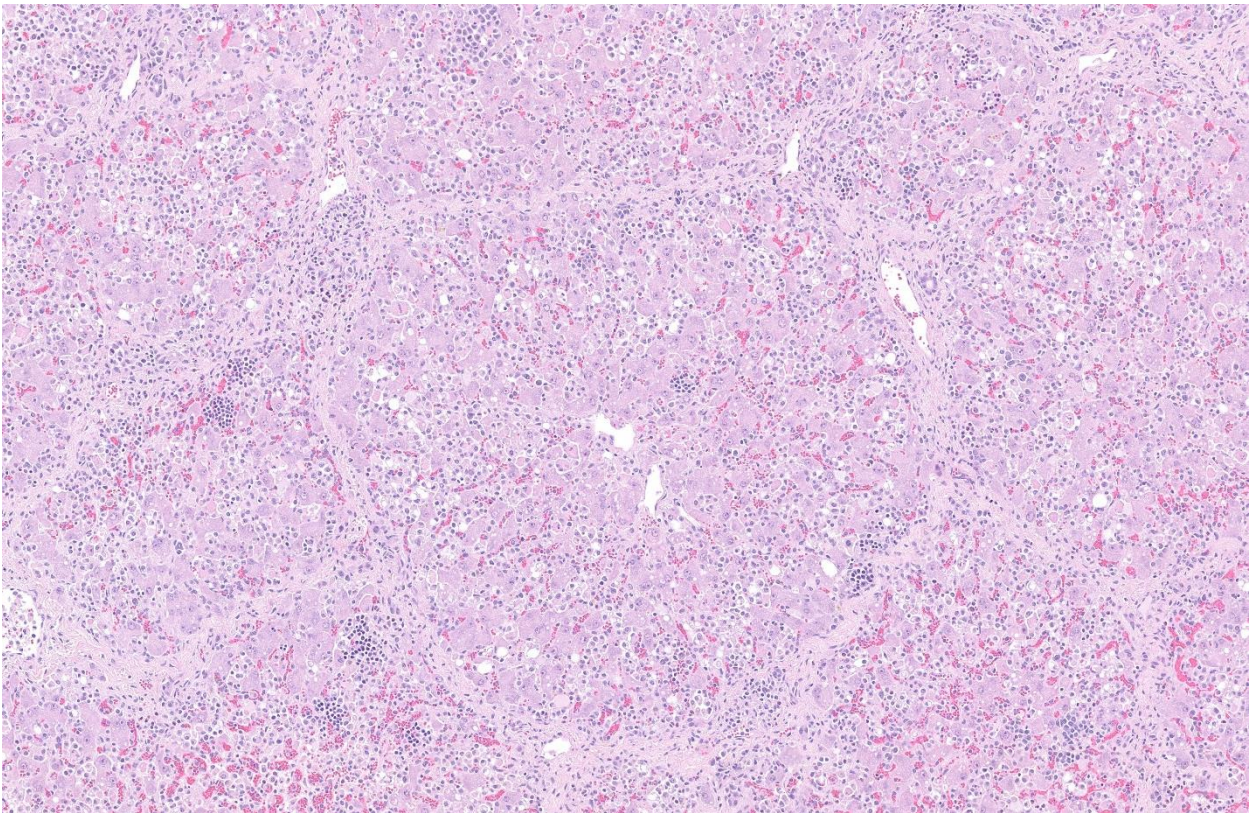


Figure 2: Liver. H&E, 100x.

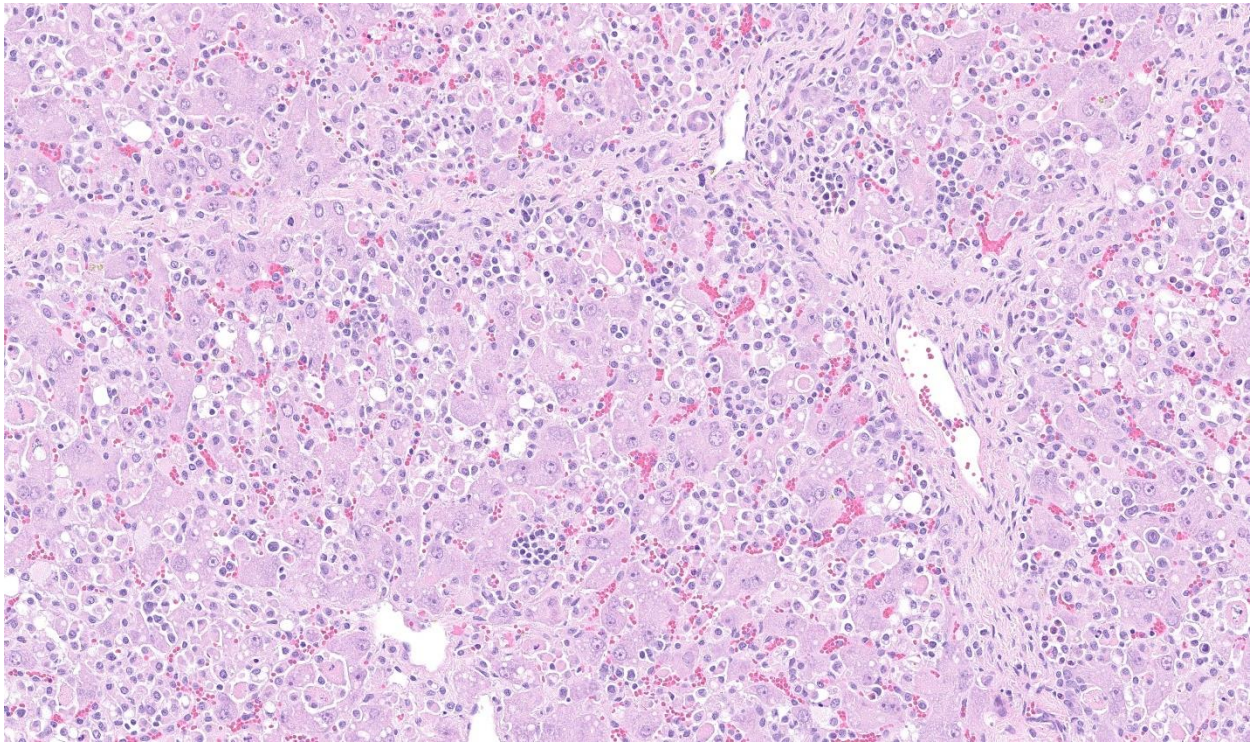


Figure 3: Liver. H&E, 200x.

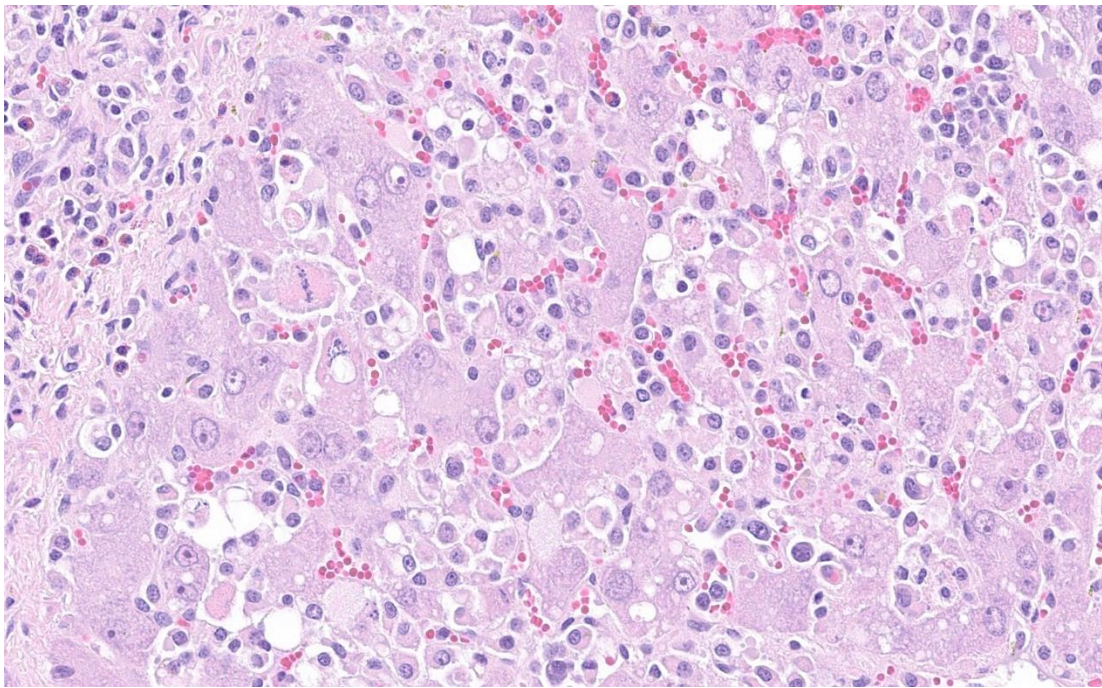


Figure 4: Liver. H&E, 400x.

Follow-up questions: Histologic description, morphologic diagnosis, cause, name the disease, possible lesions in other organs.

Histologic description:

Liver: Diffusely, the hepatic surface has an undulating appearance, hepatic lobules markedly vary in size, the hepatic plate architecture is lost. In each lobule, there is diffuse loss of 20 to 60% of hepatocytes with widespread individual hepatocellular necrosis, apoptotic bodies, frequent clusters of hematopoietic cells in various stages of maturation (extramedullary hematopoiesis), moderate numbers of macrophages, and fewer lymphocytes and erythrocytes. Remaining hepatocytes have moderate anisocytosis, many are 2 to 3 times larger than expected and have multiple nuclei (2 to 5 nuclei are commonly observed) (regeneration), and occasionally have low to moderate numbers of intracytoplasmic, round, clear vacuoles (degeneration). Rare individual hepatocytes have 2 to 3 times enlarged nuclei (karyomegaly). A few lymphocytes and plasma cells multifocally infiltrate the portal areas (Figures 1, 2, 3, and 4).

Morphologic diagnosis:

Liver: Hepatitis, lymphohistiocytic and necrotizing, diffuse, moderate, subacute, with hepatocellular degeneration and regeneration.

Lesions in other organs:

Severe and diffuse lymphoid depletion with infiltration of macrophages was present in the lymph node, tonsil, periarteriolar lymphoid sheaths of the spleen, and the bronchial-associated lymphoid tissue (BALT) and peribronchial interstitium of the lung (Figure 5).

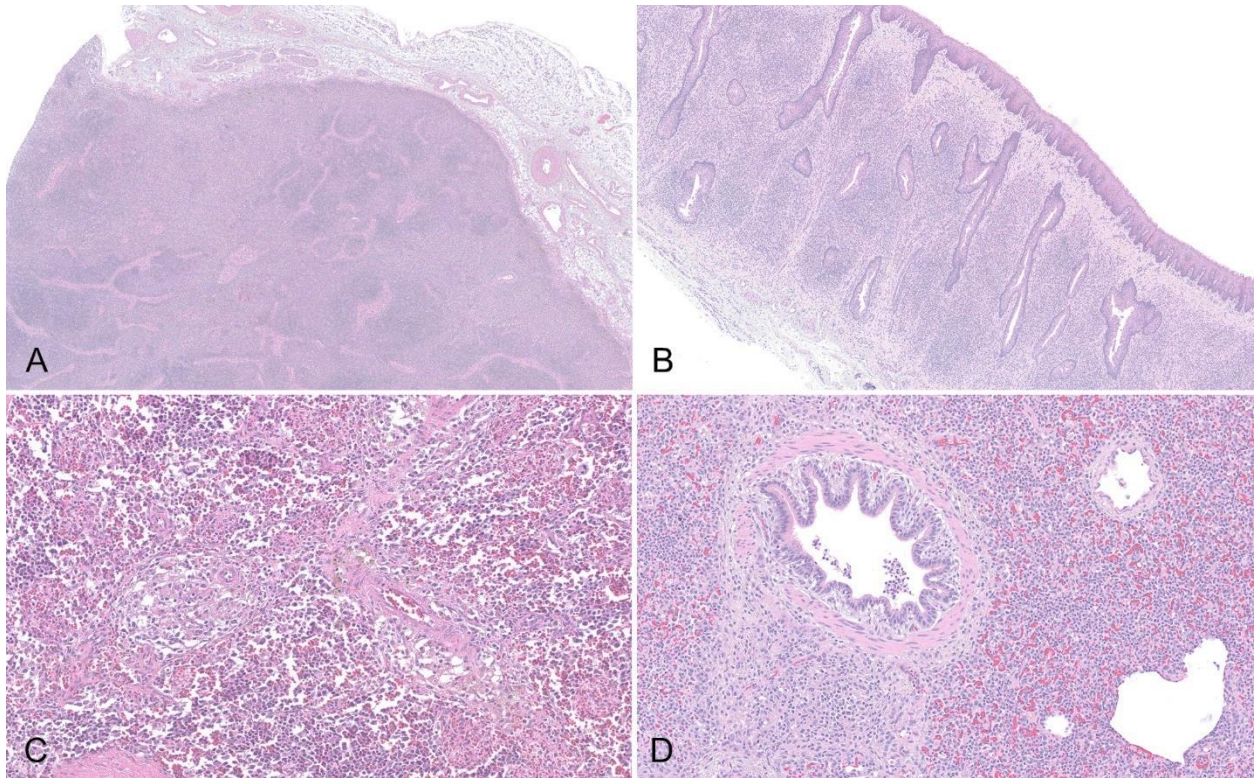


FIGURE 5: Severe lymphoid depletion and infiltration of macrophages in the lymph node (A), tonsil (B), spleen (C), and lung (D). H&E.

Ancillary tests:

- Porcine circovirus 2 (PCV2) real-time PCR: PCV2 was detected in the spleen at a cycle threshold (Ct) value of 6.2.
- Immunohistochemistry: Strong cytoplasmic immunoreactivity for PCV2 was observed in numerous macrophages and hepatocytes in the liver, and in numerous macrophages in the spleen, tonsil, lymph node, and lung (Figure 6).

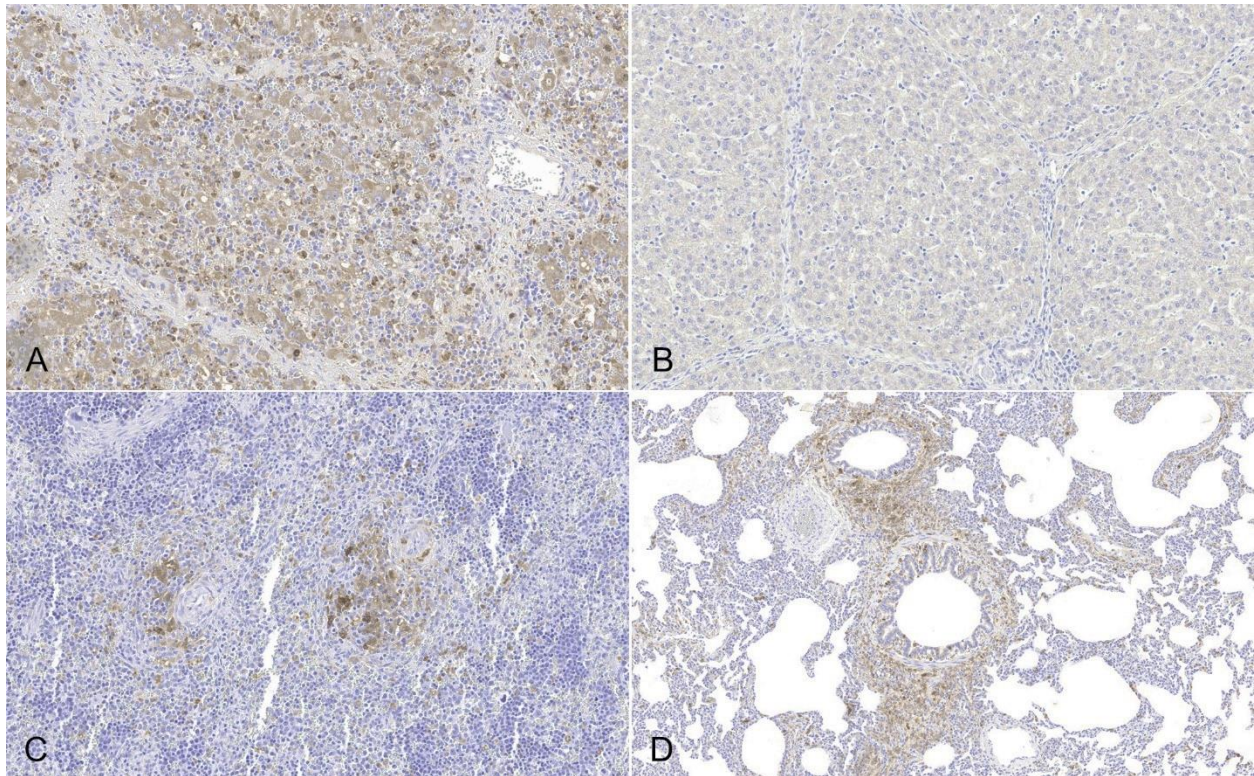


FIGURE 6: Strong cytoplasmic immunoreactivity for PCV2 is present in numerous macrophages in multiple organs and in hepatocytes. A: Liver from the affected pig. B: Liver from a non-affected pig of similar age for comparison. C and D: Spleen and lung from the affected pig. PCV2 immunohistochemistry; DAB chromogen.

Cause: Porcine circovirus 2.

Name the disease: Post-weaning multisystemic wasting syndrome.

Comments: Porcine circovirus 2 may affect the liver as part of a systemic disease also known as post-weaning multisystemic wasting syndrome (1, 3, 4, 5, 6). Common lesions with this agent are lymphoid depletion in various lymphoid organs (e.g., lymph nodes, spleen, tonsils, thymus, BALT, GALT) and histiocytic or lymphohistiocytic infiltrates within lymphoid organs and occasionally other tissues (e.g., lung, liver, kidney, intestine). The inflammatory infiltrates may also include a few multinucleated giant cells and typically have a peribronchial/peribronchiolar location in the lung (3, 6). Characteristic intracytoplasmic, basophilic, botryoid inclusion bodies are considered pathognomonic and are most common in macrophages but may also occur in epithelial cells such as hepatocytes, renal tubular epithelium, and bronchial mucosa and glands (1, 2, 3, 6). Notably in field cases, observable inclusions are much less common today compared to when the disease first emerged and were in fact absent in this case (personal communication and reference 3).

While mild to moderate, periportal, lymphohistiocytic hepatitis is common with PCV2 infection, severe hepatitis with hepatocellular necrosis/apoptosis, vacuolation, and karyomegaly as seen in this case occurs only sporadically (5, 6). Bile stasis and icterus may also be present in some affected pigs (1, 5, 6). The morphology of the hepatic lesions alone may resemble a toxic hepatic injury on histology, especially when typical viral inclusions are absent like in this case. When other organs are available for evaluation, severe lymphoid depletion in multiple lymphoid tissues along with histiocytic infiltration in multiple organs is highly suggestive of PCV2 infection. This diagnosis was confirmed by detection of PCV2 by immunohistochemistry and PCR at low Ct levels in this case.

Porcine circovirus 2 is an immunosuppressive agent and death commonly occurs due to secondary bacterial or other viral infections (6). A secondary bacterial bronchopneumonia and septicemia with *Glaesserella parasuis* and *Streptococcus suis* was present in this case.

References:

1. Hirai T, Nunoya T, Ihara T, Kusanagi K, Kato T, Shibuya K. Acute hepatitis in a piglet experimentally inoculated with tissue homogenates from pigs with post weaning multisystemic wasting syndrome. J Vet Med Sci. 2003;65(9):1041-5.
2. Huang YY, Walther I, Martinson SA, Lopez A, Yason C, Godson DL, Clark EG, Simko E. Porcine circovirus 2 inclusion bodies in pulmonary and renal epithelial cells. Vet Pathol. 2008; 45:640-644.
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4. Resendes AR, Majó N, van den Ingh TS, Mateu E, Domingo M, Calsamiglia M, Rosell C, Segalés J, Domingo M. Hepatitis and staging of hepatic damage in pigs naturally infected with porcine circovirus type 2. Vet Pathol. 2000;37(6):687-92.
5. Segalés J, Allan GM, Domingo M. Circoviruses. In: Zimmerman JJ, ed. *Diseases of Swine*. 11th ed. Hoboken, NJ: Wiley-Blackwell. 2019;473-87.
6. Segalés J. Apoptosis in postweaning multisystemic wasting syndrome (PMWS) hepatitis in pigs naturally infected with porcine circovirus type 2 (PCV2). Vet J. 2011;189:72-6.

*The Diagnostic Exercises are an initiative of the **Latin Comparative Pathology Group (LCPG)**, the Latin American subdivision of The Davis-Thompson Foundation. These exercises are contributed by members and non-members from any country of residence. Consider submitting an exercise! A final document containing this material with answers and a brief discussion will be posted on the CL Davis website (<https://davisthompsonfoundation.org/diagnostic-exercise/>).

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